WATER WORKS & SEWERAGE

A GILLETTE PUBLICATION

EDITOR

NOVEMBER 1938
VOLUME 85, No. 11

In MEADVILLE, Pa

Located in the extreme Northwestern corner of Pennsylvania, Meadville is a city having a population of 19,354, and is the center of a rich agricultural district. Here is the home of Allegheny College, a College of Liberal Arts of high standing, founded in 1815. This city has an interesting historical background; its Sesqui-Centennial was celebrated in May of this year.

Meadville is also an important industrial center, which includes the plant of the American Viscose Corporation, world's largest manufacturer of rayon, and the three plants of Talon, Incorporated, world's largest manufacturer of the widely used slide fastener.

The first public water system was built in 1874 by a private company and was purchased by the City of Meadville in 1899. The water supply is from wells located one mile from the city and is unusual in quality as no treatment of any kind is required. The wells are in glacial gravel, two of them producing over 2000 G. P. M. each.

The system is 100% metered, Pittsburgh Water Meters being used, some of which have been in service for forty years. The Water Department operates entirely on its own revenues and is free from debt.

PITTSBURGH WATER METERS

This outfall from the sewage disposal plant at Burlingame, California, is a striking example of the universal reliance on cast iron pipe as a corrosion-resistant material. Not only is the line cast iron but it is supported by U. S. Super-de Lavaud cast iron pipe acting as piles. Sanitation engineers also rely on cast iron pipe for great structural strength and permanently tight, infiltration-proof joints. U. S. Cast Iron Pipe, either pit-cast or Super-de Lavaud *chill-free* centrifugally cast, is quickly available anywhere. Stocks carried at 15 shipping points.

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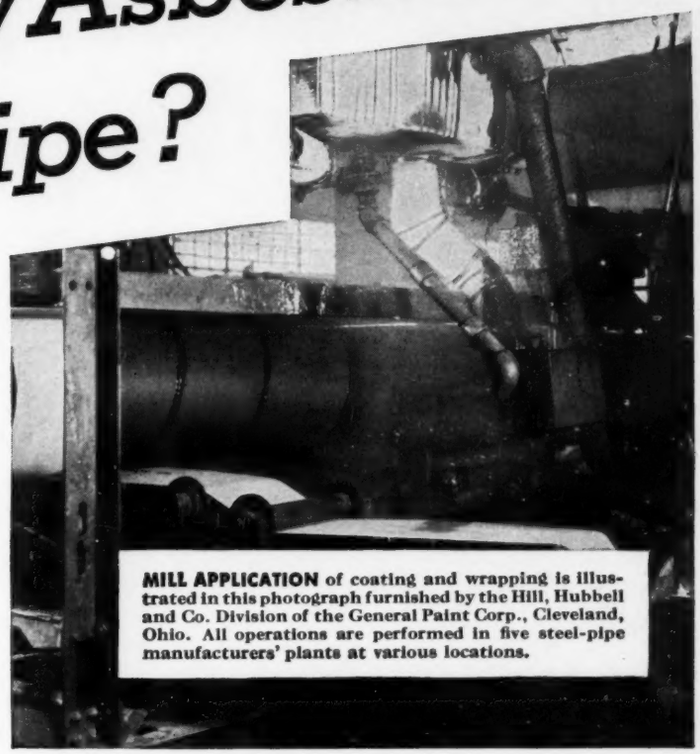

MILL APPLICATION of coating and wrapping is illustrated in this photograph furnished by the Hill, Hubbell and Co. Division of the General Paint Corp., Cleveland, Ohio. All operations are performed in five steel-pipe manufacturers' plants at various locations.

YARD APPLICATION may be done in your own pipe yard by the use of a portable coating and wrapping machine available through the Pipe Line Service Corp., Maywood, Ill.

ASBESTOS is immune to rot and decay—exceptionally resistant to all forms of corrosion—and virtually indestructible. In the form of J-M Asbestos Pipe-Line Felt, this permanent mineral is the logical choice for wrapping underground pipe lines.

Strong and tough, J-M Asbestos Felt effectively reinforces the coating against distortion and abrasion. Inorganic, therefore non-tubular, it is waterproof—cannot support capillary action under any conditions. And its great resistance to soil corrosion assures maximum protection throughout years of service—even when pipe is laid in acid or alkaline soil.

During the past 25 years more than 30,000 miles of underground pipe lines have proved the superiority of Johns-Manville Asbestos Pipe-Line Felts. You can obtain either mill-wrapped pipe, or, if you prefer, arrangements may be made for coating and wrapping in your own pipe yard. For details write to Johns-Manville, 22 East 40th St., New York, N. Y.

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ASBESTOS PIPE-LINE FELTS

WATER WORKS AND SEWERAGE, November, 1938. Volume 85. Number 11. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States and Canada, $2.00 per year; Foreign, $3.00 per year. Copyright, 1938. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

THE HORTONSPHERE

cuts OPERATING COSTS for Sheboygan Wis. Sewage Plant

ONE of the important phases of the recently completed sewage disposal plant at Sheboygan, Wisconsin, is the utilization of gas generated in the digesters, to reduce operating cost.

In order to insure a constant supply of gas, the 50 ft. dia. Hortonsphere shown above was installed. It is used to store all excess sewage gas under pressure up to a maximum of 40 lbs. per sq. in. The gas collected from the digesters flows directly to gas-burning engines, which supply power for pumping. Gas for heating purpose is piped directly from the digesters. All surplus gas over that required for these operations is pumped into the Hortonsphere, to be used during low gas production periods. Water works engineers will recognize in this the same principle as is followed in using elevated water storage tanks to smooth out pumping rates.

The use of Hortonspheres for this type of service offers definite advantages in eliminating unsightly gas holders, assuring complete freedom from odor nuisances and preventing the solids in the digesters from becoming permeated with gas. For complete information about Hortonspheres for gas storage service, address our nearest office.

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Crane large valves for water works, filtration plants, and sewage systems are engineered with the same precision and care that has made all other Crane-Equipment for such service, renowned from coast to coast. Sound construction in every part is what accounts for their positive action—tight and true. Scientific control of manufacture from raw materials to finished product results in their smooth and efficient function through long years of dependable service.

Thus, for uncommon quality in valves both large and small—in flow-control equipment for every need of your water works and sewage system, look to your Crane No. 52 Catalog.

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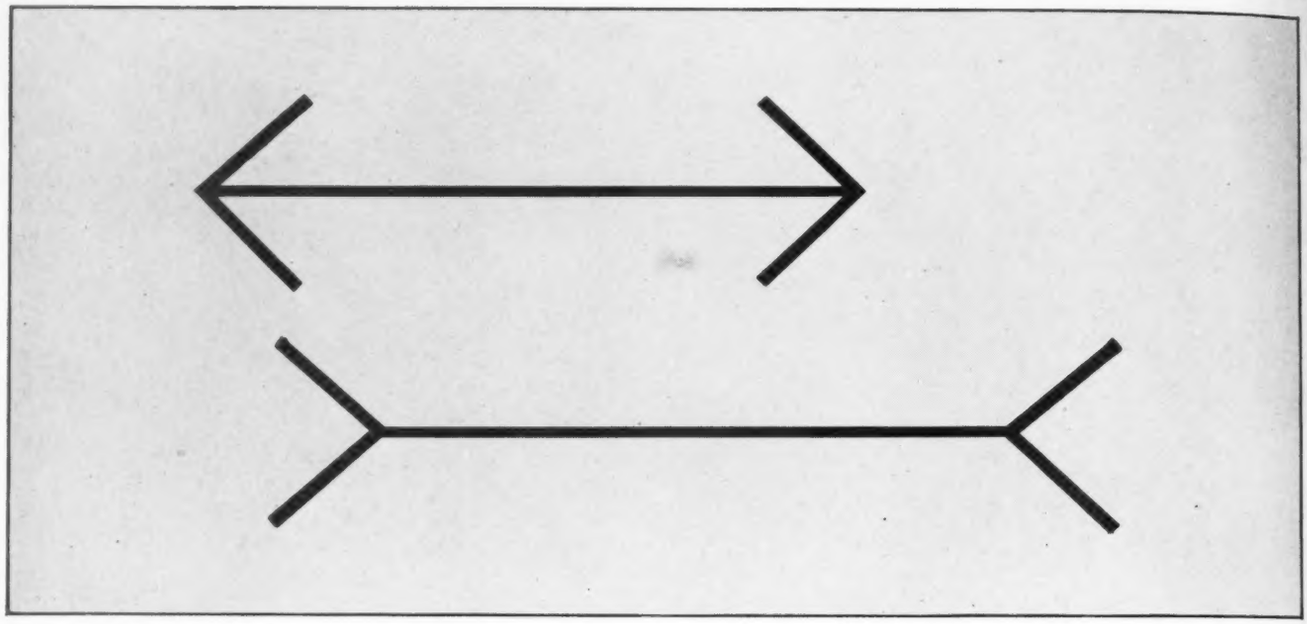

YOU must measure to be sure.

The same principle applies to activated carbons. For best results, you must measure their capacity to remove tastes and odors from the water you have to treat.

The Threshold Odor Test has proven both reliable and impartial for determining carbon efficiency in water treatment.

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4. **It handles easily in dry feed machines.**
5. **It is designed to remove the particular tastes and odors found in water supplies.**

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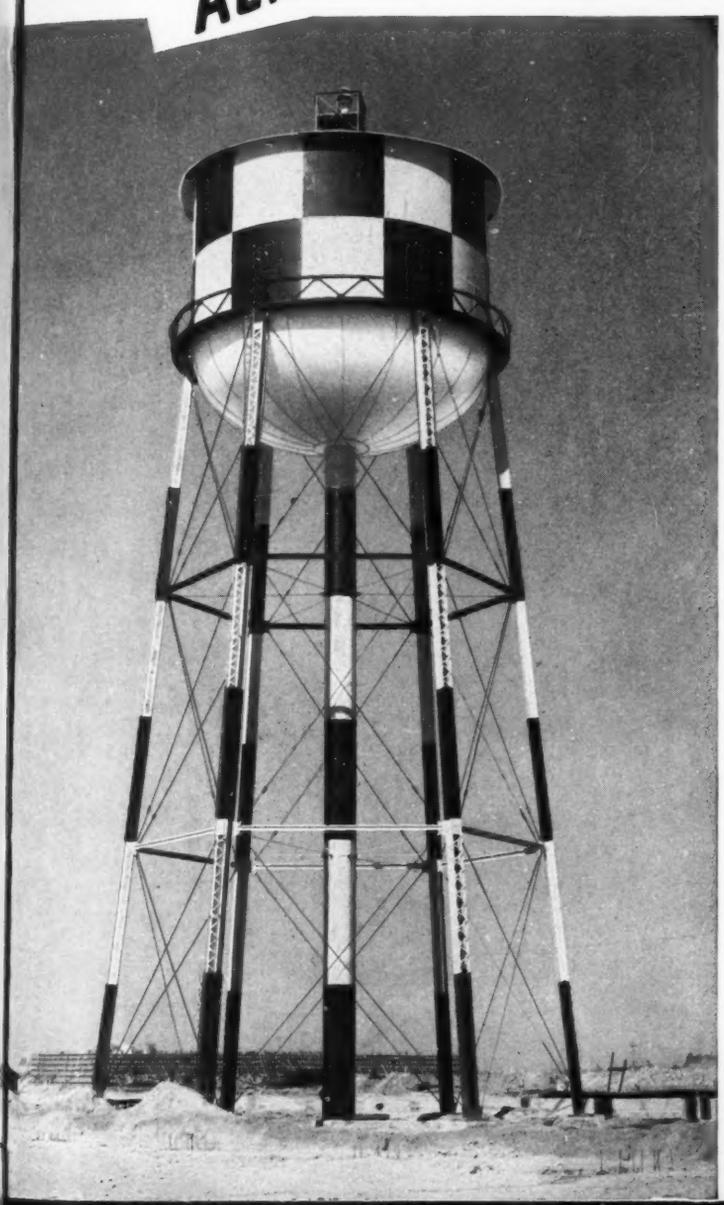

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Sacramento, California

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Providing 24-hour-a-day assurance of unfailing supply, this typical P·DM installation smooths out peak demands on the pumps, permitting them to operate most economically at regular periods—continues supply during interruptions in pumping—lowers costs all down the line, *beginning with first cost.*

Investigate what elevated water storage by P·DM can do for *your* municipality or company—we'll be glad to oblige with a consultation, our more than forty years of tank-building experience may prove useful to you!

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HOW CHARLESTON'S NEW 18½-MILE TUNNEL WAS STERILIZED

CHARLESTON'S NEW TUNNEL TO THE EDISTO RIVER WAS BUILT THROUGH MARL FORMATION. NO LINING WAS USED.

JAMES E. GIBSON, Manager and Engineer of the Charleston, S. C., Water Department who had charge of the entire tunnel undertaking—the man who made Charleston's dream come true.

A JOB THAT CALLED FOR HTH

CHARLESTON citizens gasped when three far-sighted engineers proposed a tunnel to the Edisto River for the city's water supply. But that was back in 1853. A few months ago the last 18½ miles of that "impossible" 23-mile tunnel were sterilized and put in service; a 75-year old dream had become a reality.

How Charleston's own Water Department, under the generalship of James E. Gibson, built 23 miles of unlined tunnel through marl formation is a story of unusual engineering accomplishment. No innovation, however, was the well-tested method of sterilization selected for the completed tunnel.

"We gave the matter careful thought," writes Mr. Gibson, "and finally reached the conclusion that the use of High Test Hypochlorite was the most feasible and practical method of securing the desired results. We accordingly purchased from The Mathieson Alkali Works (Inc.) 500 pounds of High Test Hypochlorite."

Mr. Gibson then goes on to describe how the tunnel was sterilized, how the easily-transported hypochlorite was introduced in the tunnel at different points, how the water was first admitted from the Edisto River and then from Goose Creek and finally washed out into the Ashley River through the outfall gates at Shaft No. 12. Commenting upon the effectiveness of the sterilization, Mr. Gibson states that "bacteriological tests of the discharge from the shaft through the tunnel compared favorably with tests of the raw water in the river at the intake."

Water works men aren't often faced with the task of sterilizing such a stretch of tunnel. But Mr. Gibson's experience is typical of that of hundreds of others who have found HTH indispensable for all manner of special and emergency chlorination jobs, from treatment of an isolated well to chlorination of an entire reservoir.

Scores of just such unusual jobs, as well as many routine jobs, are discussed in detail in "Hypo-Chlorination of Water," an 80-page manual of practical information for water works officials. Send now for a copy of the new third edition.

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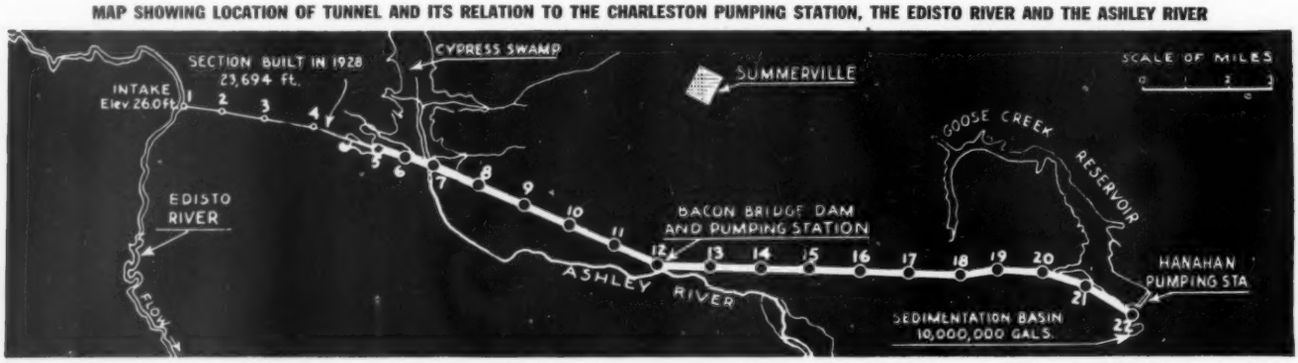
MAP SHOWING LOCATION OF TUNNEL AND ITS RELATION TO THE CHARLESTON PUMPING STATION, THE EDISTO RIVER AND THE ASHLEY RIVER



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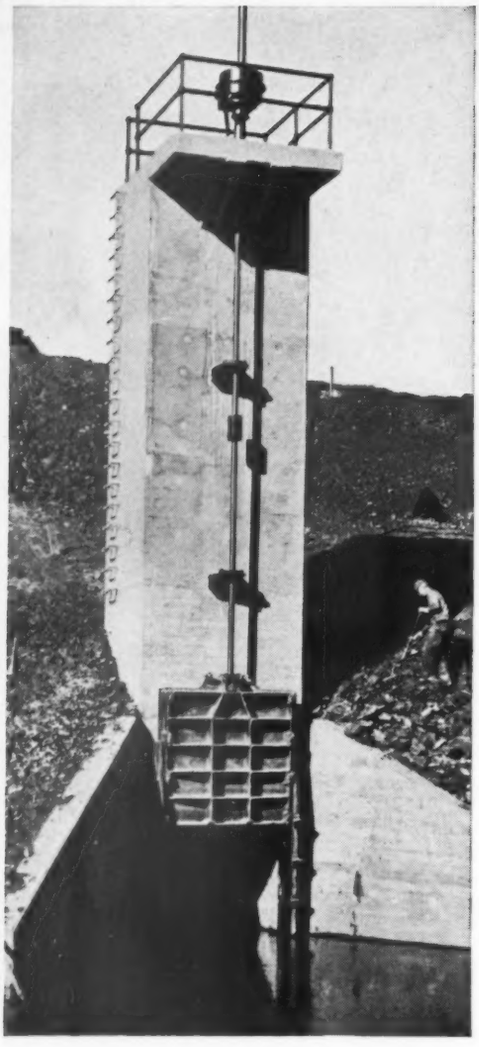

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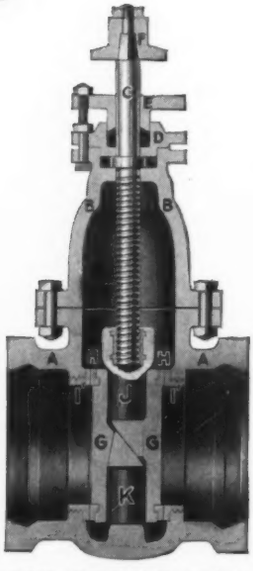

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MASSACHUSETTS—The bottle-tight Simplex Couplings used in jointing Transite lines consist of a Transite sleeve and two rubber rings. Their flexibility permits laying straight lengths of pipe on long sweeps without special fittings.

THE SHUTTER CLICKS...

and the candid camera records more proof the trend is to TRANSITE PIPE

TEXAS—Because of its asbestos-cement composition, Transite is immune to tuberculation. After years of service, its high delivery capacity of C-140 remains unaffected by this evil.

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INDIANA—Transite Pipe is strong and durable, immune to electrolysis, highly resistant to corrosion. Even under severe service conditions, Transite cuts upkeep costs to a minimum.

SOUTH CAROLINA—New installations of Transite Pressure Pipe all over the country attest to the many savings and the increased efficiency this modern asbestos-cement pipe provides.

THESE candid-camera shots, taken at random throughout the country, illustrate a growing realization in the waterworks industry . . . Transite Pressure Pipe costs less to install, less to maintain and provides more efficient and economical water-carrying service.

This modern asbestos-cement pipe combines every advantage of long life and low cost. Strong, durable and highly resistant to all forms of corrosion, it assures virtually trouble-free service throughout the years. Bottle-tight Simplex Couplings prevent joint leakage and the resulting undermining and breakage of pipe.

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Yet, with all these advantages, Transite costs no more than ordinary pipe. For complete details, write for the Transite Pressure Pipe brochure. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

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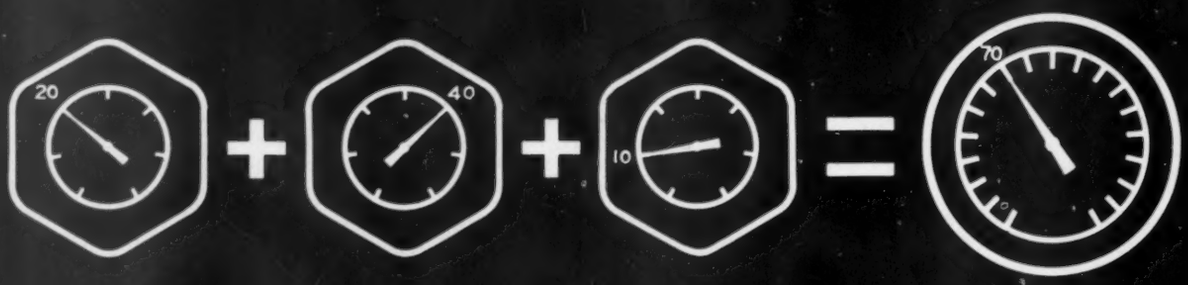

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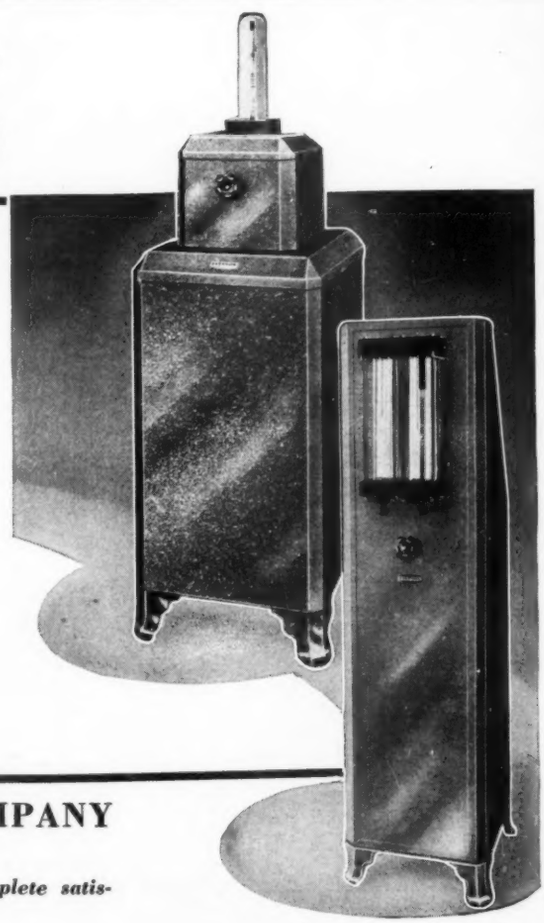

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WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher — L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

Reeves J. Newsom,* Consulting Engineer, New York City, is to be this year's reviewer of **"Progress and Developments in Water Supply and Treatment"** scheduled for our annual water supply review number—the first issue of the new year. (*President of the American Water Works Association.)

The **Central States Sewage Works Association,** boasting many experts and top-notch operators, met at Neenah-Menasha, Wisconsin, in October. The papers and discussions were such as to warrant more space for credible reporting than proved available in this issue. Look for it in December.

The "Rootin'-Tootin' " **Southwest Section of A.W.W.A.** staged a record breaking convention in Oklahoma City last month; thus proving the value of a worthy technical program, a live-wire local committee, and the effectiveness of well planned advance publicity. The proceedings of this outstanding meeting must also be held over an issue.

"Sewage Disposal in Germany" is a contribution from a world renowned sewerage authority and consultant, Dr.-Ing. Karl Imhoff of Essen, Germany. For a time it looked as though the thickening war-clouds would prevent the completion of Dr. Imhoff's paper, but fortunately not.

That **"Dear Bill Letter"** by D. R. Taylor, Roanoke, Va.'s live-wire Superintendent of Water Works, which appears in this issue, reveals a very helpful "kink" which many other superintendents should find of equal value. This is only the beginning, because "Doc" Taylor has just been "signed up" for a series of his "Dear Bill Letters" from one Super to another. "D. R." is fuller of Kinks and Gadgets than a dog is of fleas—so why not start a "Kink Binder" going with his series of "letters." There'll be a variety of kink articles during the year to add to that binder if started—for instance, that already announced from Roland Leveque, Filtration Supt., —and another series on "Metering Practices" by F. W. E. Weisse,* of Corpus Christi, Texas. (*Mr. Weisse was last month voted the Geo. W. Fuller Award by A.W.W.A.)

"A Safety Scheme for Chlorination Stations" is described, with plans in detail, by Homer G. Shockley, one of the engineer-designers of the New York Board of Water Supply.

"Operating Experiences at the Topeka, Kan., Sewage Treatment Plant," as recounted by T. R. Haseltine, is a follow-up article to that devoted to the design features of the Topeka plant in our October issue, also by Mr. Haseltine. The author, now Supt. of Sewerage at Butler, Pa., served as resident engineer on the Topeka plant.

"Degreasing Sewage," by Gordon J. Wiest, Plant Chemist, Lancaster, Pa., Sewage Treatment Plant, constitutes a recital of the author's experiences with plant scale "aero-chlorination" as a method of throwing out greases in the primary settling tanks. Mr. Wiest also discusses the attendant improvements observed in the functioning of the activated sludge process on a more even keel and consistently so.

Vol. 85, No. 11

CONTENTS FOR NOVEMBER, 1938

The New Filter Plant of the St. Louis County Water Co. 1023
By W. V. WEIR
Superintendent, St. Louis County Water Co., University City, Mo.

Bio-Chemical Treatment for Anderson, Ind. 1029
By RUSSELL B. MOORE
Consulting Engineer, Indianapolis

New York and New England Sewage Associations Hold Second Joint Meeting 1035

Manganese and Iron Deposition 1043
By R. B. ADAMS
Chemist, Pennsylvania Water Co., Wilkinsburg, Pa.

How Much Does It Cost to Make a Main Extension? 1047
By D. R. TAYLOR
Plant Superintendent, Water Dept., Roanoke, Va.

A New Method of Tank Protection 1049
By O. B. HESS
Superintendent of Water Works, St. Clairsville, Ohio

Annual Convention of California Sewage Works Association 1055

18th Ohio Water Conference 1060

New England Water Works Association Proceedings—Part 2 1067

Bio-Flocculation at the New Brunswick, N. J., Sewage Plant 1072
By HARRY W. GEHM
Rutgers University, New Brunswick, N. J.

The Editor's Comments 1075

Equipment News 1076

Meetings Scheduled 1078

Catalogs and Literature Received 1078

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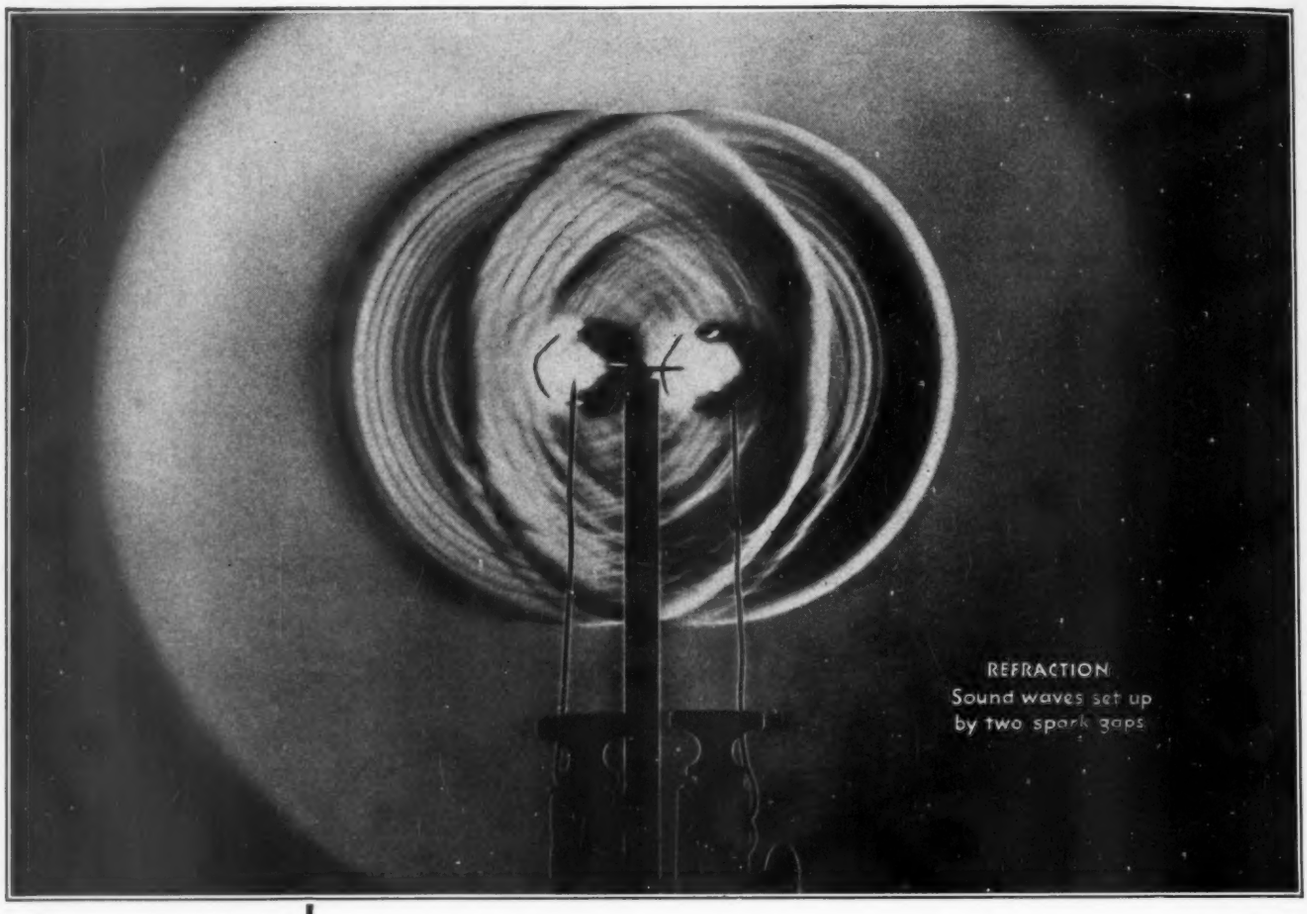
It's there—even tho' you can't see it!



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PRECISION-BUILT WATER METERS

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 85. NOVEMBER, 1938 No. 11

THE NEW FILTER PLANT OF THE ST. LOUIS COUNTY WATER CO.

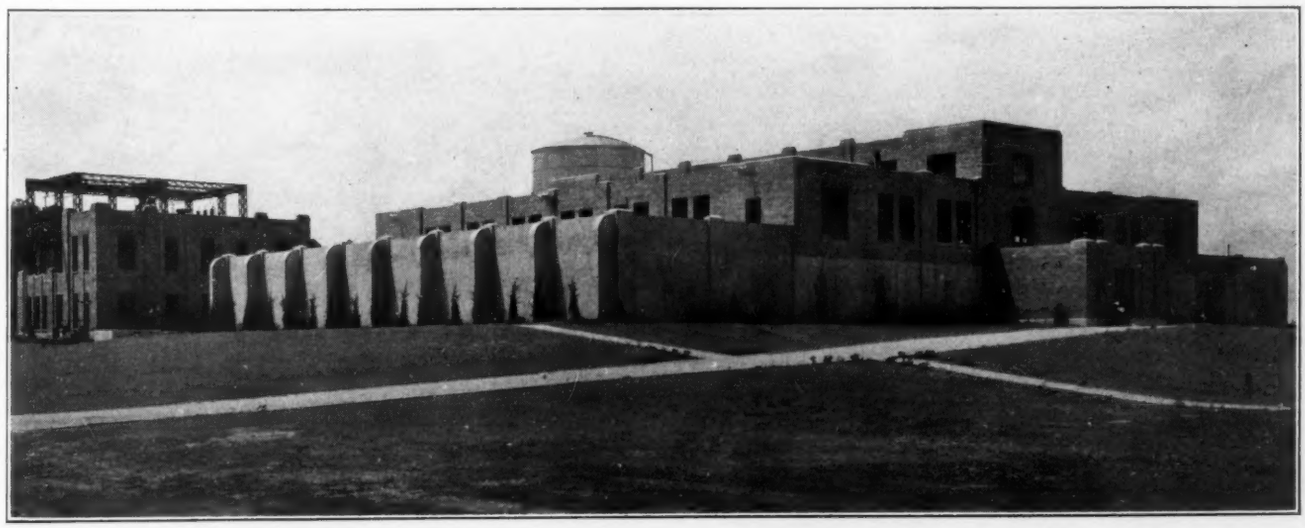
Designed for 3 G. P. M. Per Sq. Ft. of Filter Area; Employs Secondary Flocculation Aided By Silicate Treatment

By W. V. WEIR
Superintendent, St. Louis County Water Co., University City, Mo.

THE latest and most modern filter plant in Missouri was placed in service in January, 1938. This new 36-million-gallon-per-day plant supplies water to the residents of St. Louis County in the urban and suburban areas surrounding the City of St. Louis on the North, West and South.

The St. Louis County Water Company began operations (thru a predecessor company) in 1904, delivering clarified Missouri River water thru a single twelve inch main to the residents of five widely separated communities in St. Louis County. In the ensuing thirty-four years, the population served by the Company has grown from less than 10,000 to more than 200,000. Seven hundred and forty miles of mains are installed in a 160 square mile area, serving approximately 43,000 consumers.

The problem of extending the facilities of the plant to adequately supply this rapidly growing community has necessarily been exacting. Fill and draw, brick-lined sedimentation basins were originally provided to clarify the turbid Missouri River water. Additional basins of this same type were constructed in 1913 and 1924. In 1931 six parallel, mechanically cleaned settling units of the "Straightline" type were installed ahead of the clarifying basins, and pre-treatment with lime for softening was transferred to these basins. The first adequate mixing device, a concrete around-the-end baffled chamber, was installed at the same time between the pre-settling units and the clarifying basins for the application of coagulant. In 1932 recarbonation was added, the carbon dioxide being obtained by burning fuel oil. Pre-chloramination was also added in 1932.



New 36 M.G.D. Filter Plant of the St. Louis County Water Co. Left (rear): Pumping Station on floating foundation; "Two-in-One" Filter Plant. Divided by central pipe gallery are two batteries of filters, with two secondary flocculating basins flanking each; a wash-tank of 160,000 gals. capacity in the rear. (Here is a study in functional architecture made pleasing.)
A Pipe Gallery With Worthy Features

A Filter Plant Projected

The continued production of finished water meeting U. S. Treasury Standards was obtained with this plant only by constant and careful attention to all of the purification processes, since the raw water exhibited great variations in physical chemical qualities. Turbidities averaged above 2,000 p.p.m., mounting at times as high as 18,000 p.p.m. The laboratory control of these processes, the constant experimenting necessary, and the experience gained while operating this plant, provided a valuable background for the design of the present filter plant on which construction was started in December, 1936.

Charles E. Jutz, President St. Louis County Water Co.

W. Victor Weir, Supt., St. Louis County Water Co.

A comprehensive study of the desirable filtering rate was necessary to determine the area of the sand filter beds. In other plants no well defined movement was found in the direction of departing from the 125 m.g.a.d. (2 g.p.m./sq. ft) rating established in the Louisville experiments in 1907. However, because of the proven ability of the existing plant to produce water meeting Treasury Standards without filtration, and taking consideration of the additional conditioning treatment provided immediately head of filtration, a filtering rate of 187½ m.g.a.d. (3 g.p.m./sq. ft) was considered feasible and therefore adopted as the basis for the design of this new plant, upon approval by the Missouri State Board of Health.

Before starting the design of the filter plant structure, a thorough investigation of the bearing value of the soil was made at the site of the new plant, which is in the alluvial plain of the Missouri River bottom. Core drillings to solid rock were taken. Since the soil was found to be composed of irregular stratifications of silt, quicksand, sand and gumbo, it was found necessary to support the plant on piles. These piles were concrete, poured into steel shells which were driven to proper penetration by the use of a steel driving mandrel placed inside the shells. About 900 piles ranging in length from 22 to 41 feet were required.

Low Lift Arrangements

The introduction of filtration into the plant scheme required the installation of low head pumps to lift water from the existing finished water basin to the filter plant. These pumps being required to deliver greatly varying quantities of water, three two-speed electric motor driven centrifugals were installed. All three units have the same high speed of 588 r.p.m., but the low speeds are different, being 500, 435 and 385 r.p.m. Nine well-spaced delivery steps are available, using either one or two pumps at a time. Any two of these pumps when operated at high speed will deliver water to the maximum capacity of the filter plant. Provision is also made for throttling the discharge lines of the pumps so that any desired delivery can be obtained. Differential taps in the pump casings in combination with differential head metering registers measure and record the discharge of the low head pumps. When two pumps are operating, the delivery of the pumps is totalized.

Secondary Flocculation

Secondary coagulation was provided, because it was felt that the residual floc in the clarified water would probably be broken up, even in low lift pumping to the filters. The coagulant is fed into the pump suction line

Interior View of St. Louis County Water Co.'s New Filter Plant Designed for 3 Gal. Per Sq. Ft. Per Minute Rates. Employs Note clear well and wash-rate gages in rear; influent sluice-gates at rear of each filter; wash-rate setting and recording mechan-

and the turbulence in the pumps affords an excellent quick-mix. A gravimetric coagulant feeder is automatically controlled by the pump delivery meters, increasing or decreasing the coagulant in proportion to the amount of water pumped to the filter plant.

Five-shaft "Flocculators" of the horizontal paddle wheel type were installed in basins on each side of the filter units. The minimum detention period of 45 minutes develops the floc and conditions the influent so that water can be filtered to a turbidity of 0.2 p.p.m. or less at the designed filtering rate of 3 g.p.m./sq. ft. The twelve-foot diameter paddles have a constant peripheral speed of approximately one foot per second.

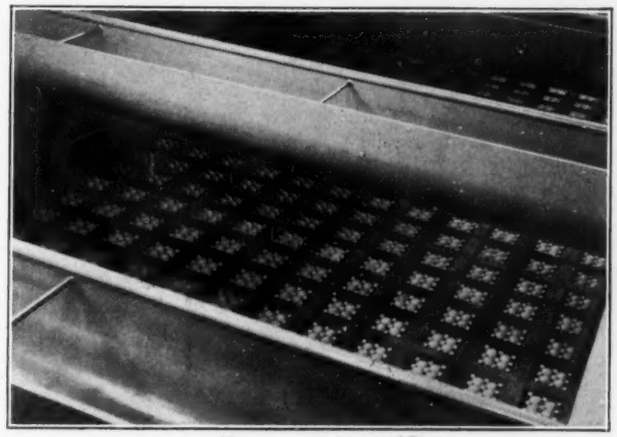
Two-in-One Design

Eight filter units of 4½ m.g.d. each are installed. These are arranged in two four unit sections on opposite sides of a common pipe gallery. Each section has its own influent line, flocculation basin, and a clear well beneath the four filters. Each half of the plant can be operated as a separate plant of 18 m.g.d. capacity.

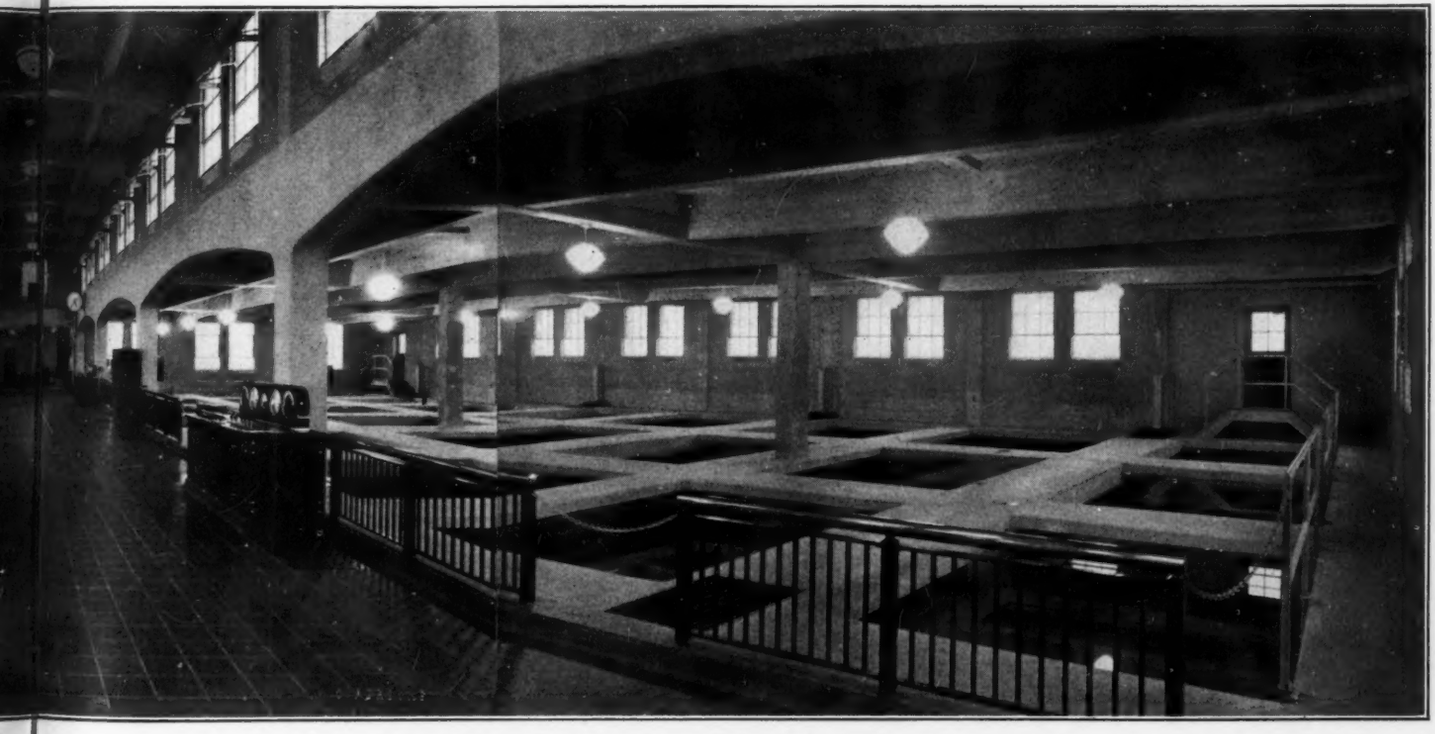
The filter underdrain system is a Wheeler type false bottom. Pre-cast concrete units two feet square, containing four Wheeler units, are supported on cylindrical concrete columns two feet high set on two-foot centers. The Wheeler units were cast upside down, the depressions being formed by using four cast iron frustrums of four-sided pyramids in each form. Porcelain throat inserts were fastened to each frustrum and the concrete was vibrated as each unit was cast. Porcelain spheres of graduated sizes distribute the wash water uniformly beneath the filter gravel.

Twelve inches of Muscatine gravel, from ¾ inch to No. 10 mesh, support twenty-seven inches of Muscatine sand having an effective size of 0.45 m.m. and a uniformity co-efficient of 1.4. The sand was conveyed hydraulically through pipe and hose from the freight cars to the filter beds, a distance of approximately 400 feet, at the rate of 12 tons per hour.

Filtered water passes from the two-foot deep collecting chamber under each Wheeler bottom through direct acting rate controllers to the clear wells. Instead of sliding a weight, the rate setting for each filter is adjusted by allowing water to flow into or out of buckets hung on the rate controller counterbalance arms. This adjustment is made from the operating tables. Similar buckets are fastened to the opposite ends of the counterbalance arms of the rate controllers. Being direct-connected from their bottoms through a flexible rubber hose to the clear-well, as the clear wells fill these buckets also fill. The effect is a gradual reduction of rate of filtration uniformly applied to all filters and eventually the controllers close tight to prevent overflowing the clear wells. Clear well levels are shown on a large double-pointer gauge located on the operating floor. Clear well level alarms are also located in the high service pumping station.



Section of a Filter—Showing Arrangement of Porcelain Balls in Place in Wheeler Corrosion-Proof False Bottom. Troughs are of welded copper-bearing steel with rounded lips.



Primary and Secondary Flocculation and Ferric Sulphate and Silicate of Soda in Coagulation. ism in right center. Note lighting arrangement, excellence of concrete work and pleasing finish.

Washing Facilities

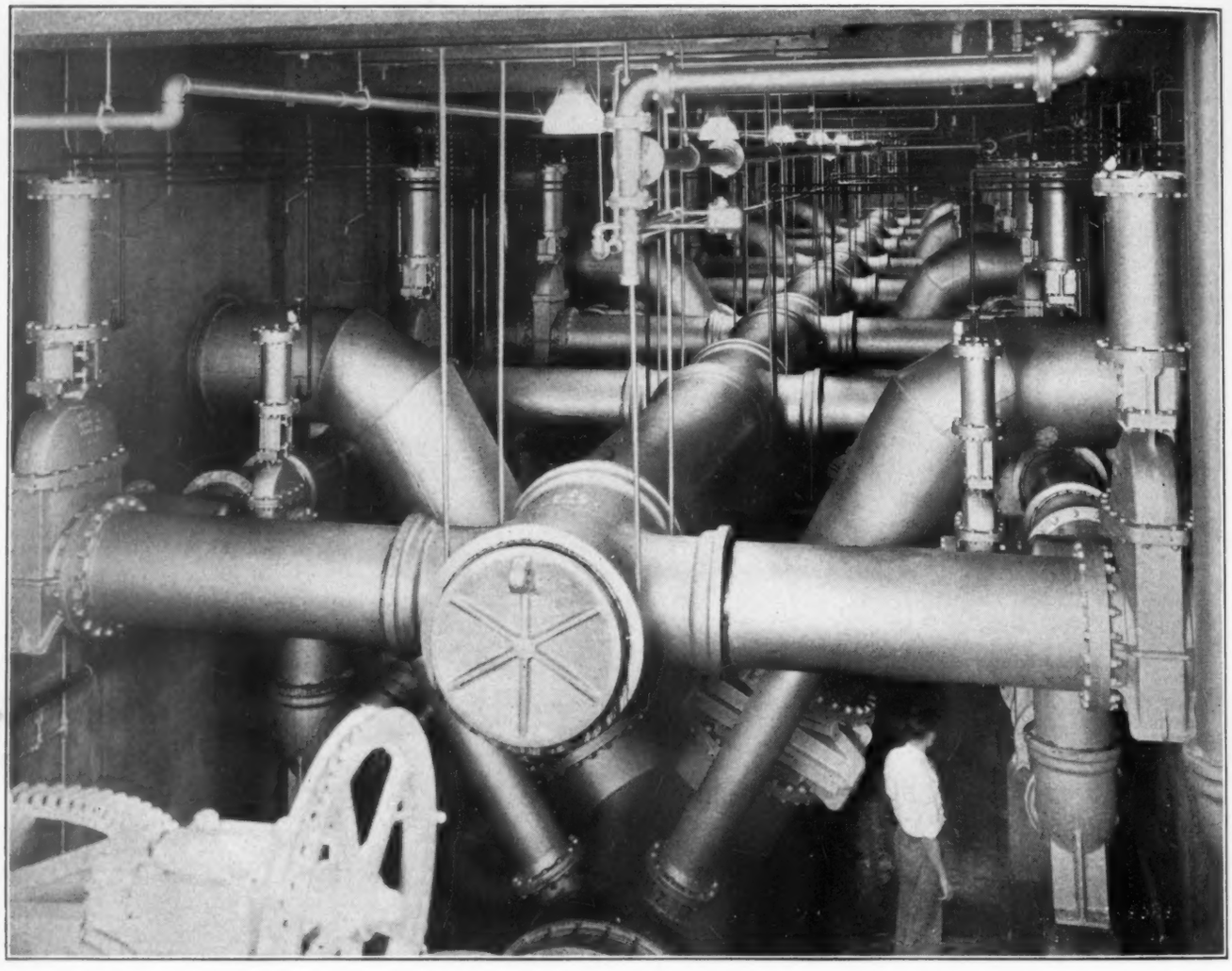
Wash water is pumped from the clear wells to an outside 160,000-gallon elevated tank by means of a float-controlled motor-driven centrifugal pump. A stand-by connection between the high service pumps and the tank is also installed. A twenty-inch diameter wash water connection supplies each half filter unit from the thirty-inch diameter wash water main. This design allows the use of wash rates as high as forty-two inches per minute if desired, and half filter may be washed at considerably higher rates. The rate of wash is regulated by a rate controller in which a butterfly valve maintains head and flow desired, the setting being adjusted from the operating floor. A large, gauge, hung at the end of the operating floor, shows the controller rate setting by means of a revolving light behind the opal glass face. Actual rate of wash and depth of water in the tank are shown by pointers in front of the face. Wash rates are graduated in both inches rise per minute and thousand gallons per minute. A recording gauge makes a permanent record of the rate of wash, and a totalizer shows the amount of water used.

Inasmuch as the sewer line will be filled with river water, at times of extreme river stage, provisions were made for washing filters at such times by operating a centrifugal "Mixflo" pump installed in a by-pass around a valve in the 42-in. sewer line. This pump has sufficient capacity to permit washing a half filter at a thirty-inch per minute rise.

Valving

"Square bottom" double-disc gate valves, hydraulically operated, are installed for controlling all filtering operations. The filter influent valves, however, are hydraulically operated sluice gates which connect the flocculating basins with the rear of the filters. The "square bottom" gates were selected because of their ability to function smoothly under unbalanced pressures encountered in filter plants. Their distinctive feature is found in the fact that the gate rings do not contact the seat rings until the valves are practically closed.

Four double operating tables of black ebonite serve the eight individual filters. Indicating and recording rate of flow and loss of head gauges, all valve controls, valve position indicators, and the filter rate-changing levers are located on these tables. Twin sight wells with white tile floors, and illuminated by submarine lights, afford visual inspection of the finished water in each clear well.



A Pipe Gallery with Worthy Features

Suspended 30 in. C. I. wash line (center); welded steel sewer and waste branches; note neatness of all-copper control piping; use of "square-bottom" valves; absence of filter influent lines; excellence of lighting and working conditions.

Plant Architecture

The architecture of the filter plant is functional, rather than monumental. The materials are concrete, buff-colored brick and limestone trim. Plywood forms were used for all exposed concrete surfaces, and these exposed surfaces were rubbed to a smooth finish. The concrete was vibrated as it was placed.

[The end result brings due admiration from the most critical visitor.—Ed.]

One operator per eight-hour shift performs all work, excepting mechanical maintenance, in the filter plant. He keeps all records, makes effluent turbidity tests, washes filters (after first surface washing the sand with a high pressure fire hose stream), and performs all other necessary and incidental operations.

Operating Experience

Although this new plant has been in service for only a short while, a definite effort has been made to obtain operating experience as quickly as possible. Two of the eight filters were operated continuously through the month of April at the design rate of 3 gals./sq. ft./min. No difficulty was encountered. Throughout the month of May, the same two filters were successfully operated at a filtering rate of 3⅔ gals./sq. ft./min. The operation of the plant through the summer of 1938 bore out the original belief that, with proper water conditioning and reasonable care in the operation of the plant, the design filtering rate of 3 g.p.m./sq. ft. of sand area may be considered conservative.

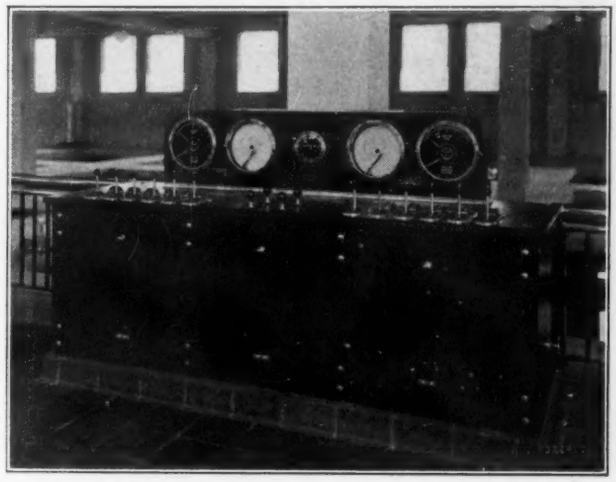
Filters are washed whenever the turbidity of the effluent exceeds 0.2 p.p.m. regardless of head loss. Turbidity tests are made bi-hourly, except on filters where the effluent turbidity is approaching the limit of 0.2 p.p.m. Hourly tests are made on the effluent of such filters.

Operating statistics for July, August and September, the three months of maximum water usage in 1938, appear in the accompanying table.

The influent turbidity has been found to have a direct bearing upon the filtering results. With higher influent turbidities, greater secondary coagulant dosages are required to properly coagulate the turbidity. The turbidity and floc load causes shorter filter runs and proportionately higher quantities of wash water. These increased costs are to some extent counterbalanced by lower primary coagulant costs. The optimum influent turbidity has not yet been established, although it appears that the total cost of primary and secondary coagulants and wash water is lowest when the influent turbidity is about 5 p.p.m. With an influent turbidity of 5 p.p.m., long filter runs are obtained, during which time the filters consistently produce an effluent with a turbidity of 0.1 p.p.m. or less.

Surface Scrub Plus High-Velocity Wash

Repeated tests for mud balls in the filter sand have been made, using the method suggested by Baylis. (J. A. W. W. A. Vol. 29, P. 1021). No mud balls have been found. Before washing, the water level in the bed is drawn down a few inches below the sand surface. The surface is then thoroughly "scrubbed" by going over the entire sand surface with the stream from a half-inch nozzle attached to fifty feet of two-inch hose. Water at 140 lbs. pressure is used. The filter is then washed (at a 39-inch per minute rise during August) until the appearance of the water indicates that the sand is clean. Wash periods average about five minutes in length.



One of the Four Double Operating Tables, Serving Two Filters Each. Constructed of Ebonite, indicating and recording rate of flow and loss of head gages, electric clock in rear panel; in the center are the filter rate setting knobs.

The bacterial load placed on the filters is very light, since the influent water is pre-chlorinated. The average 37° C. count for the last seven months has been 46 bacteria per m.l. in the filter influent, and the average reduction in filtration has been in excess of 50 per cent. Chloramine treatment is applied to the filter plant effluent.

Since space is not available to describe the features of the plant in more detail, naming the manufacturers of the most important equipment should possess informative value:

The Allis-Chalmers Mfg. Co.—two speed motors and pumps.

The Simplex Valve & Meter Co.—pump meters, rate control equipment, indicating and recording gauges, alarms, distance transmission equipment.

The Dorr Company—flocculators.

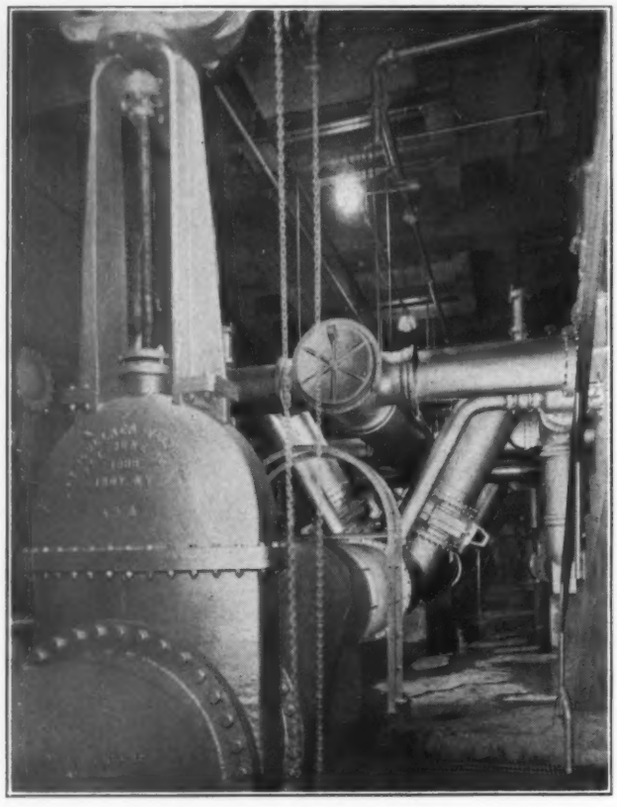
The International Filter Co.—filter operating tables.

The Patterson Foundry & Mach. Co.—porcelain thimbles and balls for Wheeler bottoms.

OPERATING STATISTICS

	July	*August*	*September*
Secondary Coagulant Used	Aluminum Sulfate and Sodium Silicate	Ferric Sulfate* and Sodium Silicate	Ferric Sulfate* and Sodium Silicate
Average influent turbidity	6.4 p.p.m.	3.4 p.p.m.	5.3 p.p.m.
Average filtering rate (gal./sq. ft./min.)	1.5 gals.	1.6 gals.	1.4 gals.
Average length filter run	76.5 hours	111.4 hours	92.3 hours
Average filter run (thousand gallons)	7,394	10,187	8,565
Average filter run (gal./sq. ft. sand area)	7,000	10,400	8,110
Average loss of head at washing	8.2 feet	6.9 feet	5.2 feet
Average wash water used	1.11%	0.86%	1.03%
Maximum filtering rate (gal./sq. ft./min.)	2.9 gals.	3.1 gals.	3.0 gals.

*Ferric sulfate with sodium silicate was used as the secondary coagulant during August and September, based on laboratory demonstrations of efficacy, as a plant scale test.



Another Pipe Gallery View

Looking along the 42-inch Dresser coupled steel-sewer. In the foreground is the 42-in. hydraulic valve which keeps high water out while a "Mixflo" centrifugal discharges dirty wash water around this back-water "dam."

The Rensselaer Valve Co.—"square bottom" and other gate valves.

The Chapman Valve Mfg. Co.—throttling check valves and sluice gates.

The Omega Machine Co.—gravimetric chemical feeders.

The Wallace & Tiernan Co.—chlorinators and ammoniators.

Plant Design Statistics

Nominal capacity—36 M.G.D.
Rate of filtration—187.5 M.G. per acre daily.
Number of units—8.
Size of units—4½ M.G.D.
Depth of filter box—10 ft. 4 in
Thickness of sand—27 inches.
Effective size—0.45 m.m.
Uniformity coefficient—1.4.
Thickness of gravel—12 inches.
Size of gravel—10-mesh to ¾-inch.
Type of strainer system—Wheeler bottom (pre-cast units).
Rate of wash—42-in. maximum rise.
Agitation of sand (surface wash)—wash with half-inch nozzle at 140 lbs. pressure.
Height—sand to trough crest—2 ft. 6 in.
Clear distance between troughs—4 ft. 10 in.
Location of wash gullet—center.
Wash tank capacity—160,000 gallons.
Tank bottom above sand surface—25 ft. 9 in.
Per cent wash water (average)—1.0 per cent.

The plant was built by the United Engineers and Constructors, Inc., of Philadelphia, Pa. On several phases of the work Francis S. Friel, of Philadelphia, served as consulting engineer.

PORTLAND STANDPIPE WAS NOT COATED WITH "BITUMASTIC" ENAMEL

In our October issue appeared a spectacular and rather rare picture of a water tower afire. An account of the happening was contributed by F. J. Reny, Treasurer and General Manager of the Portland Water District (Maine), which owns the stand-pipe.

We learn now that the material used in coating and lining the stand-pipe was not "Bitumastic Enamel" which we interpreted it to be, but was a bituminous enamel. The word "Bitumastic" is a coined term for a coal-tar base enamel produced by one particular firm; and, since this particular material was not employed, Mr. Reny has suggested that a correction be run. In referring to "bitumastic enamel" in his account, Mr. Reny advises that the material employed was, in fact, a bituminous coating. All such material put on as a hot application has heretofore been referred to as "bitumastic enamel" in the Portland Water District offices, but without the capitalization of the first letters in each word as was done in setting up the article.

To the author, and to the manufacturers of "Bitumastic Enamel," our sincere regrets over having misinterpreted the meaning of the term and the resultant use of capitals.

▼

C. J. VELZ HEADS CIVIL AND SANITARY ENGINEERING DEPT. AT MANHATTAN

It has recently been announced by Brother Amandus Leo, Dean of Engineering at Manhattan College, that Clarence J. Velz has been made head of the Department of Civil and Sanitary Engineering at Manhattan.

Professor Velz holds the degree of Civil Engineer from the University of Minnesota, and a Master of Science degree in Public Health from Columbia University.

While serving as State P.W.A. Engineer for New Jersey, under his supervision came the building of a number and variety of sewage treatment plants. So he goes to his new position enriched with recent valuable practical experience, in addition to his background as a civil and sanitary engineer.

Under construction at Manhattan is a new Hydraulics Laboratory and also a laboratory for sanitary analyses and research.

▼

LAWRENCE MADE WATER COMMISSIONER OF CLEVELAND

W. C. Lawrence,

W. C. Lawrence, until recently Superintendent of Cleveland's Baldwin Filters, has been made Commissioner of Water and Heat.

Mr. Lawrence, a native Clevelander, has been connected with the Water Department of Cleveland for 31 years, having started as a clerk in 1907 and worked his way through to the position he has long held as Superintendent of Filtration.

Bill's many friends will be happy to learn of his promotion. And, Frank O. Wallene, Director of Utilities at Cleveland, deserves the admiration of water works men for having recognized a career-man for the top job in the Water Department.

BIO-CHEMICAL TREATMENT FOR ANDERSON, IND.

Chosen on Basis of Sufficiency and Economics

By RUSSEL B. MOORE
Consulting Engineer,
Indianapolis, Indiana

The Author

A PROGRESSIVE Hoosier community—the city of Anderson, Indiana—fell behind in the march of progress to end the pollution of White River, the source of water supply of a number of municipalities downstream. Raw sewage and trade wastes were being discharged into the river without treatment. While, upstream from Anderson, some twenty miles, the city of Muncie was proceeding with a major sanitary project, Indianapolis, at the same time, forty miles downstream, was completing improvements to its Sewage Treatment Works. The State Department of Health used every means in its power to persuade the city of Anderson to inaugurate the construction of intercepting sewers and a Sewage Treatment Works. Later, Anderson found itself decidedly back of the proverbial eight ball. And, with considerable reluctance but no alternative, the city was obliged to proceed, to comply with the Health Department's requirements and initiated a program that will, in its culmination, meet the full demands of the State.

On November 21, 1938, the combined efforts of the Common Council, the Board of Public Works and the Mayor will be manifested by the letting of contracts for the construction of a modern sewage treatment plant.

Actually, the efforts of the city of Anderson to eliminate the pollution of White River dates back some fifteen years. Various reports have been prepared indicating the construction costs of the necessary intercepting sewers and sewage treatment plant as approximately two million dollars. Trickling filters and activated sludge plants had been considered, with various alternate appurtenances.

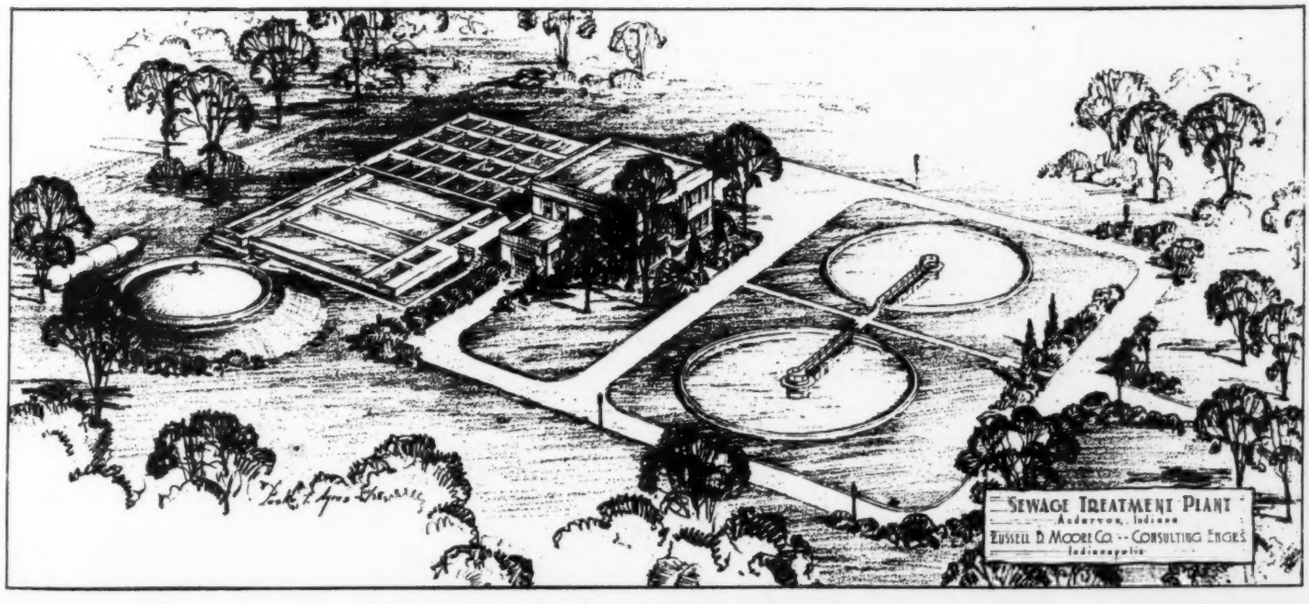
The constitutional bond limit of the city of Anderson was $660,000. Obviously, it was impossible to more than dent the problem with these funds until "Uncle Sam," through the Public Works Administration, provided another "45 per cent grant." The Works Progress Administration was likewise willing and ready to contribute their good offices to such of the work as would come under their auspices.

Today approximately 50 per cent of the intercepting sewers are completed with W.P.A. labor. The treatment plant is, at this time, advertised with the aid and assistance of P.W.A. The entire cost of the project will be about one million dollars.

Selection of the Method

Consideration was given to previous studies by engineers, together with our own field investigations. Activated sludge, trickling filters, chemical precipitation and bio-chemical treatment were partially planned and estimated. After several conferences with the city officials it was decided that the Guggenheim Bio-chemical Process would, from the many angles considered, best meet the needs of Anderson.

The present population of the city is approximately 40,000. It is a thriving industrial center that is experi-



Artists' Drawing of Anderson's New Plant.

encing a rapid growth. The sewage includes industrial wastes from packing plants, steel manufacturing industries, together with domestic wastes, all to be treated. The Indiana Department of Health and the writer's firm measured and analyzed the sewage flow. It was determined that the sewage contained approximately 225 parts per million of suspended solids and exhibited a 5 day B.O.D. of 170 parts per million. White River, into which the sewage is discharged is a source of water supply for several communities below Anderson that lie adjacent to the river, the largest being the city of Indianapolis. Consequently, a relatively high degree of purification was deemed advisable. The sewage, plus industrial waste, will vary in concentration and character day by day and to some extent it will vary hourly. Naturally, it was necessary to select a type of treatment that would best cope with these variable conditions.

Basic Design Features

The plant is designed for an average flow of 8 million gallon, with a maximum flow of 16 million gallon per day. Primary treatment is available for the maximum flow while the secondary (bio-chemical) treatment is limited to a capacity of 12 million gallon per day. The pumping plant, located about one-half mile from the treatment works, has a 30 inch reinforced concrete force main connecting with the plant. Exceptional storm flows, above 16 M.G.D. are to be directed to the river. The pumping station is equipped with two comminutors, grit removal equipment, one 2,000 G.P.M. pump, one 3,500 G.P.M. pump and two 5,000 G.P.M. pumps. One 5,000 G.P.M. pump is a complete spare. All pumping equipment is designed for a maximum total dynamic head of 46 ft.

Primary Tanks

Two primary tanks of two lanes each (20 ft. wide by 106 ft. long) with an average water depth of 10 ft. provide primary treatment. The tanks are equipped with two straight-line collectors with one cross collector and one drive for each tank unit. Continuous removal of scum is provided by scum weirs and troughs. An overflow flume, installed at the end of each primary tank, is arranged so that flows in excess of 12 million gallon per day will be bypassed after primary treatment to the river. These primary tanks will provide 115 minutes retention of the sewage during average flows, with an overflow rate of 943 gallons per square foot per day. Immediately following the primary treatment the sewage flows through a Parshall flume designed to measure up to a maximum flow of 12 million gallons per day for secondary treatment.

With the exception of the low overflow rates for primary treatment, the first step in the treatment of the Anderson sewage is typical of other settling processes. Immediately following the Parshall flume the application of the Guggenheim Process is initiated.

The Guggenhiem Process in Brief

In our report on the Guggenheim Process in January, 1938, concerning the city of Dallas, Texas, the process was described as follows:

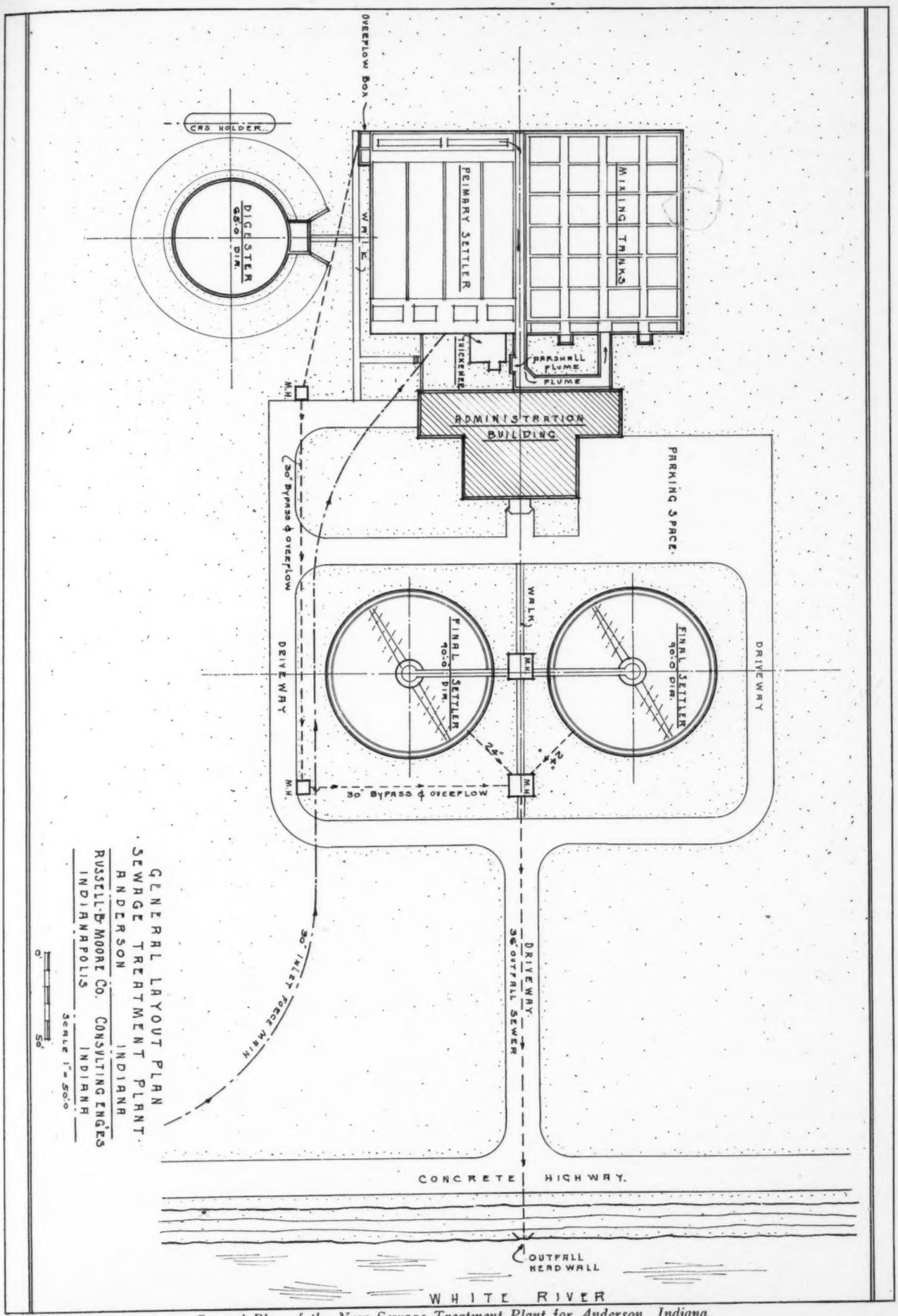
> BASIC PRINCIPLES AND APPLICATION OF THE GUGGENHEIM PROCESS
>
> The Guggenheim process is basically the treatment of sewage by the application of a soluble coagulating agent augmented by returned chemical sludge in the presence of air.
>
> The sewage first receives primary treatment in Imhoff tanks; primary settling tanks or other accepted methods of primary treatment, after which the essentials of the Guggenheim process maintain. The primary treated effluent is introduced into a tank for mixing and aeration. At the influent of this tank a coagulating agent (preferably iron in the ferric state) is introduced together with chemical sludge that is returned from a final settling tank. The sewage, ferric iron and sludge are thoroughly mixed with air. The sewage is then delivered to a final settling tank where the sludge is removed and the clarified liquor is discharged to the receiving stream. Additional treatment, such as magnetite filters, may be employed after the final settler, if a high degree of purification is required. The returned sludge mentioned, heretofore, is usually about 15 per cent of the volume of the sewage flow. Sufficient amount is delivered to the mixing tanks to maintain approximately 1,200 parts per million of suspended solids in the mixing tank. Sludge in excess of that used for recirculation is withdrawn and disposed of by any of the accepted methods.
>
> The aeration period is from 1 to 2 hours, depending upon the amount of air required and the strength of the sewage undergoing treatment. The amount of oxidized iron or other coagulating agent depends upon the character and quantity of the sewage. Broadly speaking, sewage may be treated with a range of 1 to 2 hours duration of air mixing and 2 and 10 parts per million of oxidized iron. The controlling factors of treatment in the Guggenheim process are air, returned sludge and the coagulating agent. The air oxidizes unstable compounds in the solution. The returned sludge supplies an abundance of iron compounds along with ferric hydroxide, and acts as an aid to coagulation, and as a buffer against varying loads experienced in the incoming sewage. The iron, as an aid to the coagulation, precipitates some of the compounds in solution as insoluble iron compounds and further is an acceptor of the oxygen supplied by the air.
>
> A few important characteristics of the process are as follows:
>
> Nitrogen as free ammonia passes through the process unchanged. The nitrogen as organic nitrogen is reduced approximately 66 per cent. Organic carbon is substantially reduced. Nitrates or nitrites are not apparent in the effluent, although they may be present in the raw sewage. The sludge is not as readily putrefactive as activated sludge, due to the stabilizing effect of the iron. 1½ to 2 cu. ft. per capita of sludge digestion capacity should provide adequate digestion.
>
> The iron and air applications are interchangeable and may be replaced, one by the other, depending on the relative cost of the iron and air in any given locality. Experience indicates that each part of iron may be replaced by .028 cu. ft. of air per gallon. There is, however, a certain minimum requirement of iron and/or air, since it is the combination of these two items that are, together with the sludge, the basis of the process. The Guggenheim process is definitely not a chemical precipitation plant, neither is it an activated sludge plant. Chemical precipitation relies entirely upon the sweeping action of the coagulant to reduce the suspended solids and the B. O. D. The activated sludge process depends to a large extent on the so-called higher life organisms, while in the Guggenheim process a very small amount of these are prevalent."

During the design of the Anderson plant it developed that further consideration should be given to the relationship between the iron and the air. It is our opinion that a sewage having a B.O.D. reflected principally or entirely in the suspended solids, should be treated differently from a sewage with a high B.O.D. and relatively low suspended solids. This variance of treatment is not wide and the Anderson plant is designed so that the limits of treatment are well within the operating capacity of the plant.

On Through the Plant

We left you a few paragraphs ago suspended between the Parshall flume and the aeration, or mixing tanks, so if we may have your hand, we will continue on through the plant—aided by an accompanying General Plan and the Flow Diagram.

Ahead of the mixing tanks the sewage flows through a mixing flume where the returned sludge, supernatant from sludge thickeners, and the vacuum filter filtrate are added to the settled sewage—see flow diagram. This flume is provided with air agitation. As merely agita-



General Plan of the New Sewage Treatment Plant for Anderson, Indiana.

Water Works and Sewerage—November, 1938

tion rather than oxidizing aeration is required, perforated pipe diffusers are used. These consist of thin wall tubes to reduce the probability of the perforations being plugged.

Aeration Tanks to Have Swung Diffuser Tubes

The two aeration tanks, each having two lanes (22 ft. wide by 108 ft. long and 10 ft. 6 in. deep) are designed for spiral flow. The retention of the flocculation-aeration tanks and flumes, on the basis of design flow plus 15 per cent additional capacity for returned sludge, is 2 hours.

The tubular air diffusers in the aeration tanks are arranged so that, by means of a portable electric hoist, the tube holder may be swung up to a point where the diffuser tubes are accessible from the walkways to facilitate inspection, cleaning, or replacements. The air supply pipes are run in the space under the walkways, in order that the walkways may be clear of any obstruction. The collecting flume at end of mixing tank is provided with the same type of air diffusers as for the mixing flume.

Blowers

Four blowers are provided each having a capacity of 1,000 C.F.M. at 5¼ lbs. pressure and driven by 40 H.P. motors. At design flow, with three blowers in operation, the air supply will be equivalent to .535 cu. ft. per gal. of sewage. While the fourth blower will normally be a spare unit, air piping has been made amply large to permit the use of all four blowers. The specifications have included positive pressure type blowers, with an alternate for the furnishing of centrifugal blowers.

Due to the fineness of grain of the air diffuser tubes, it was considered advisable to make special provisions for cleaning the air supplied to the blowers. A self-cleaning filter, in which the filter plates are automatically cleaned by passing through a bath of special oil, is provided. In addition there will be a renewable bag type filter, through which the air passes after passing through the self-cleaning filter.

Final Settlers

From the aeration tanks the mixed liquor flows to the final settler through a 30 inch pipe. There are two final settlers with center inlets. Each tank, 90 ft. in diameter by 8 ft. side water depth, is equipped with sludge collecting mechanisms.

The flow rate for the final settlers is 630 gal. per sq. ft. per day. The retention, without taking into account the conical bottoms of the tanks, is two hours and 17 minutes at design flow. From the final settlers, the effluent flows through the collecting manhole and outfall to the river.

Originally consideration was given to the installation of magnetite filters following the final settling units, but lack of funds precluded use of this very excellent device. With the magnetite filters a reduction could be made in the size of the final settlers. However, not sufficient savings could be made to offset the cost of the filters. It is our opinion that regardless of the elimination of these units, with the thorough final settling provided at Anderson, the B.O.D. of the effluent will not exceed an average of 15 to 20 parts per million, and the suspended solids will not exceed the same amount. Moreover, effluent polishing through filters of some sort may be added at a later time.

Chemical Handling and Feeding

The chemicals for treatment will be delivered by trucks to a receiving hopper. By means of a bucket elevator and screw conveyor these will be conveyed to the storage bins on the upper floor of the Administration Building. The hoppers for the chemical feeders are set in this floor. A platform scale is provided for weighing the chemicals before delivery to the feed hoppers. Two dry chemical feeders provided are arranged for hand adjustment, with one feeder as a complete spare. The feeders with dissolving tanks are designed for use with either copperas, in conjunction with chlorine (chlorinated copperas), or for ferric sulphate.

The dissolving tanks are lead lined with lead lined cover and vent. A mechanical agitator and an indicating flow meter on the water supply are provided. The feed chute from feeder to dissolving tank is also vented in order that the vapors produced in the dissolving of ferric sulphate will not enter the feeder and cause corrosion and clogging of the mechanism. The solution is conveyed from the dissolving tanks to the mixing flume in rubber lined pipe, in which a connection is provided for feeding chlorine as a process aid, when and if desirable, or for production of chlorinated copperas, or both.

While it is estimated that the average chemicals required for the treatment will not be more than the equivalent of 5 p.p.m. of iron (Fe), each machine has a capacity equal to 10 p.p.m. of iron at 12 M.G.D. flow of sewage.

Sludge Handling

The chemical sludge from final settlers is pumped up to the sludge control tank located on main floor of building. In this tank are the sludge measuring nozzles, one for each settler, and the sludge control valve for regulating the flow of return sludge and waste sludge. The return sludge pipe to the mixing flume is also provided with a sludge measuring nozzle. The tank is arranged so that samples of the return sludge may be readily obtained.

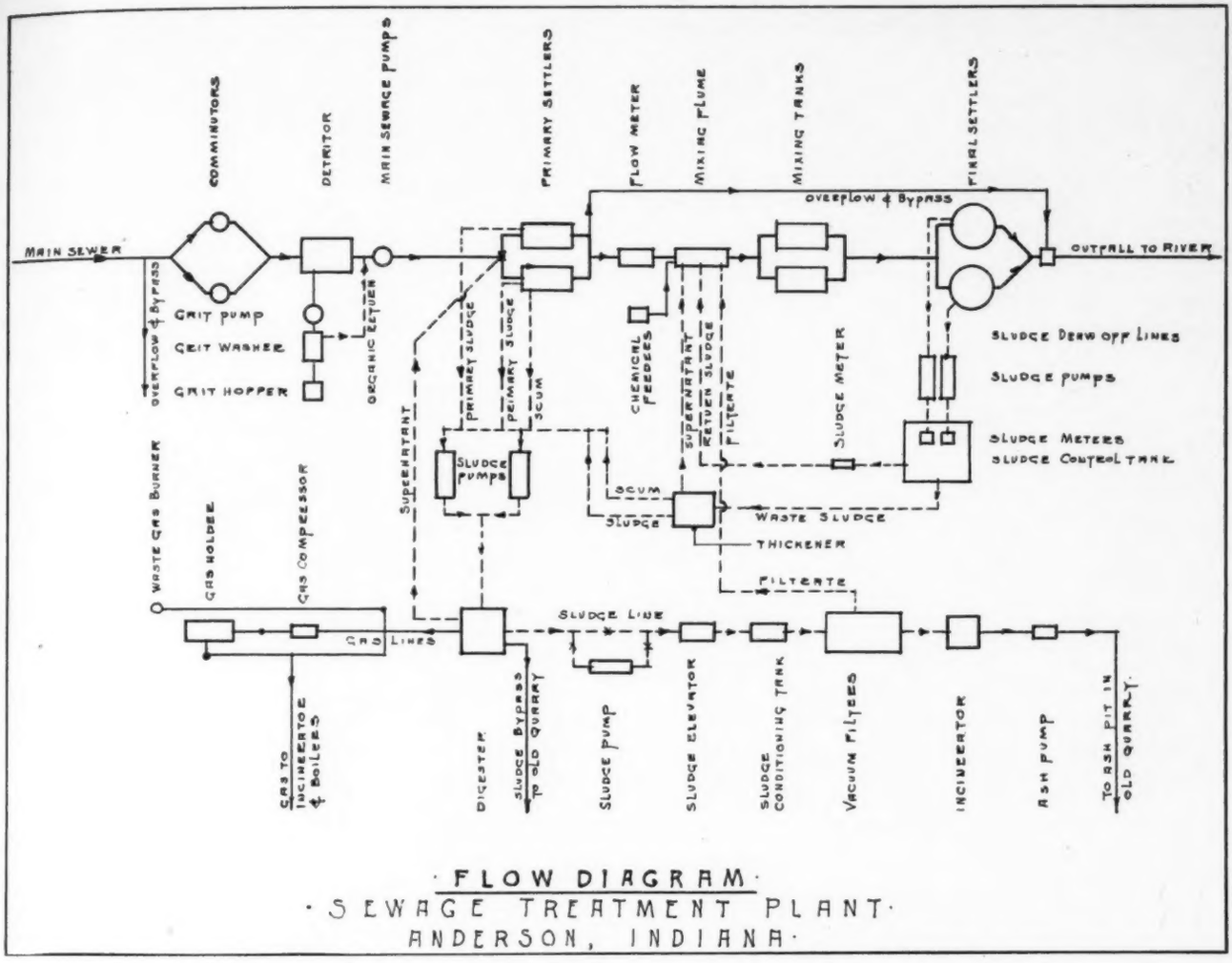
A separate pump with variable speed drive (125 to 650 g.p.m. capacity) is provided for each final settler, with a spare pump which may be used for either settler. Waste sludge flows by gravity from the sludge control tank to the chemical sludge thickener.

The sludge thickener is a Dortmund type of tank, without mechanical agitation. It is designed for a storage capacity of eighteen hours on the basis of design flow, with 2 ft. additional depth for supernatant. The scum trough provided is constructed of 12 inch pipe with an upper section cut away. The pipe may be rotated in either direction to remove the scum for discharge into a separate hopper from which it is pumped to the digestors.

Three pumps for handling primary and thickened sludges are provided, each with a variable speed drive and with a capacity of from 25 to 125 g.p.m. These pumps are to be used for pumping primary sludge, thickened chemical sludge, scum from both primary tanks and thickener, all to the digester. These pumps may also be used for draining the primary tanks. One pump may be used for pumping digested sludge if such a requirement becomes necessary.

Meterization

Meters are provided throughout the plant to measure sewage and sludge. One meter is provided for the main sewage flow between the primary and secondary treat-



Flow Diagram of the Guggenheim Bio-Chemical Process as Adapted in the Anderson Plant.

ment; two meters are installed to measure sludge withdrawn from the final settlers; and an additional meter measures returned sludge. The air supply is metered by two combined flow and pressure meters, immediately preceding the mixing tanks. Indicators for the sewage flow meter and each of the three sludge meters are mounted on a panel immediately adjacent to the sludge tank, in order that operators may readily observe the various flows when it is necessary to adjust the sludge control. This room also provides sampling facilities for raw sewage, settled sewage and plant effluent. Pumps deliver a continuous flow sample to outlets over troughs. Samples of the thickener supernatant and vacuum filter filtrate are obtained from receivers set in the floor. The recorders and integrators for these meters, together with the air flow and pressure meters for the mixing tanks, are panel mounted in the sludge control room opposite the main power and lighting panel.

Provisions for Chlorination

The plant is provided with two chlorinators with all pipe connections installed for a third chlorinator, if future operation determines its necessity. These chlorinators are 500 lb. capacity each and are located in the chemical dry feeder room. Chlorine will be purchased in carload lots in one ton containers by the Anderson Water Works. As frequently as required containers will be delivered to the Sewage Treatment Plant. Four containers will be installed in a separate room, on two recording platform scales. One chlorinator will be utilized for chlorinated copperas. The second unit will be used at miscellaneous points throughout the plant, for pre-chlorination and post-chlorination, odor control, or possibly for modifying biological behavoir in the process at times, etc.

When the secondary treatment is being bypassed, the combined output of the two chlorinators will be fed to the bypass line leaving the primary settlers. The piping is of sufficient capacity to handle the output from three 500 lb. chlorinators, if and when the third chlorinator becomes necessary and useful.

Digesters

The design of the digestion units was materially affected by the decision to install a combined sludge and garbage incinerator as part of the wastes disposal projects. The primary function of the digester is, therefore, to provide a "leveling basin" or repository for variable flows of sludge of variable nature and to provide a more uniform product for dewatering. Full scale power development from digester gas was not considered economical, since the city of Anderson owns a municipal light and power plant and the relatively small added load for sewage treatment will inconsequently affect operating costs at the generating plant.

The digester is 65 ft. in diameter with 22 ft. side wall depth. Storage to the extent of 12 days holding is provided for sludge and ground garbage, with an additional

depth of 3 ft. for supernatant, together with 2 ft. of free-board. No appreciable gas storage has been provided. A floating-cover is contemplated, resting directly on the liquids. The digester is arranged to eventually receive ground garbage as now contemplated. However, the garbage grinder, with pumps and housing, are not a part of the present plans. Maximum gas production and digestion are not considered in this design, but rather an effort has been made to obtain a sludge of fairly constant characteristics and dependable supply, that will filter readily over vacuum filters, and have a high fuel value. We do, however, anticipate that a considerable amount of gas will be produced in the twelve days' digestion.

Gas Holder of Pressure Type

A gas compressor and pressure type gas-holder are provided, with the compressor operating automatically when gas is produced in excess of immediate requirements. The gas from the holder will be automatically fed to the gas supply system through reducing valves, at times when the demand for gas is greater than the immediate production. A waste gas burner is provided to burn gas that can not be used or stored. The gas will be utilized to aid in the incineration of the sludge and ground garbage, heating the building and to maintain a temperature of 85 to 90 degrees F. in the digesters.

The digester is set at an elevation that will provide for gravity flow to the sludge elevator, for normal operation. A pump is provided for the delivery of the partically digested sludge whenever the liquid in the digester drops below the normal level, or otherwise at will.

Sludge Dewatering

Anhydrous ferric chloride, delivered in metal drums, and hydrated lime, delivered in bags, will be elevated to a storage room on the upper floor of the Main Building. These chemicals will be utilized for sludge conditioning. The chemical storage room also houses lime mixing tanks with mechanical agitation, ferric chloride dissolving tanks, together with sludge storage tanks. An acid proof pump is provided for re-circulation in the dissolving tank, and for raising the solution to the storage and solution feed tank. The sludge conditioning tank is provided with mechanical agitation. The elevator and chemical feeders are governed by a float control at the filters to maintain a predetermined level of sludge in the filter compartment, and for uniform proportional chemical dosage of the sludge.

The ferric chloride feeder is a proportioning type while the lime feeder is a bucket elevator with an adjustable speed arranged so that part of the contents of the bucket may be fed to the sludge conditioning tank, as conditions require.

Two drum-type vacuum filters with a total capacity of 400 sq. ft. will be installed on the upper floor. The filters are designed on the basis of a yield of 5 lbs. of dry solids per sq. ft. per hour of filter area. It is anticipated when the plant and sewers are in continuous operation and the city garbage is delivered for incineration, 25,000 lbs. per day of dry solids will be handled by these two filters. Adjacent to the filters an electric control panel will be installed for the operation of all motors on the filters and dewatering appurtenances.

The filter cake will be delivered by means of a belt conveyor to a hopper set in the filter room floor, through which the filter cake will discharge into the incinerator feeder located in the room under the vacuum filters.

Incineration

The total amount of filter cake per day (on the basis of 70 per cent moisture) is predicted to be 83,000 lbs. It is expected, that with the combination of digested sludge and garbage, the filter cake will not contain more than 66 to 68 per cent moisture. The capacity of the incinerator to be installed is, 60 tons of 70 per cent moisture filter cake per 24 hours.

The ash from the incinerator will be sluiced to an abandoned quarry located on the property; this quarry is of sufficient capacity to take all the ash produced for a number of years. The sluicing equipment will be entirely automatic in operation.

Effluent as Water Supply

For the water supply required for chlorinator feed, dissolving chemicals, general washing down and pipe flushing, also for ash sluicing equipment, an automatic effluent water pumping system is provided with two 100 g.p.m. pumps and pressure type storage tank.

For drinking water supply and other services where effluent water would not be suitable, a deep well with pump of 150 g.p.m. capacity and pressure storage tank is provided. No physical connection between the two water supply systems will exist.

The building will be entirely of reinforced concrete with glass block panels in the outer walls. See artist's drawing.

In arriving at the type of plant required, the city fathers of Anderson and their engineer were guided by two prerequisites. First, the funds available; and second, the character of the effluent. Unquestionably, a saving will be made of from 30 to 40 per cent over the cost of providing any other type of treatment considered adequate to meet the requirements of the State Board of Health.

It is not the writer's purpose to convey the impression that the Guggenheim Process can be considered a panacea for all sanitary ills, but we do feel that in the case of Anderson the adaptation of bio-chemical treatment is definitely the best solution to the problem.

▼

WHITLEY JOINS N.Y.U. STAFF

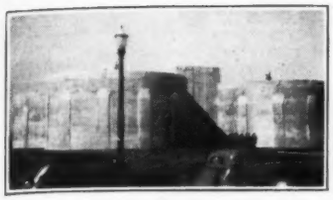
F. H. Whitely

F. H. Whitley has been appointed Instructor in Sanitary Engineering at New York University. He comes to N.Y.U. from South Dakota State College, where he was giving courses in sanitary engineering. Prior thereto he was a member of the staff of Charles De Leuw & Co., Chicago consulting engineers.

Mr. Whitley was graduated by North Carolina State College in 1932, having specialized in Sanitary Engineering. In 1936 he received a M.S. degree in Civil Engineering from the University of Illinois. He is a Junior of the Am. Soc. of Civil Engrs., a member of the Soc. for Promotion of Engineering Education, and other technical societies. His fraternities are Tau Beta Pi, Phi Kappa Phi and Sigma Xi.

Mr. Whitley will be assistant to Professor L. V. Carpenter, head of the Department of Civil and Sanitary Engineering at N.Y.U.

NEW YORK AND NEW ENGLAND SEWAGE ASSOCIATIONS HOLD SECOND JOINT MEETING



Hartford's Unique Digesters

New Britain's Novel Plant

Inspect the New Plant at Hartford and New Britain's Bio-Chemical Plant

IN Hartford, Conn., on October 7th and 8th, was held the second highly successful joint meeting of the New England and the N. Y. State Sewage Works Associations. The official registration was, however, about 5 short of the 300 or better anticipated.

A feature was the manufacturers' exhibits which were unusually attractively and instructively arranged this year around the walls of the main meeting room in which was also staged the Annual Dinner-Dance. In all 27 firms were represented.

Business Meeting

Each of the associations held a separate luncheon and business meeting on the first day. It is customary for the New England association to elect officers at its Fall meetings and the following were nominated and unanimously elected.

New England Officers—1939

President—F. W. Gilcreas,* N. Y. Dept. of Health, Albany, N. Y.

Vice-Pres. — Arthur D. Weston, Mass. Dept. of Health, Boston, Mass.

Secy.-Treas. — LeRoy Van Kleeck,* Conn. Dept. of Health, Hartford, Conn.

Directors—Walter J. Shea, R. I. Dept. of Health, Providence, R. I.; Wm. P. Petrie, Supt. of Sewerage, Norwalk, Conn.

N.E. ← Presidents → N.Y.

John H. Brooks, Sewerage Supt., Worcester, Mass.
Fred J. Beile, Consulting Engr., Huntington, L. I.

Entertainment

At this joint meeting the ladies received especial attention in the matter of entertainment and the Annual Dinner-Dance proved to be the best ever held by either of the associations. On the closing day all of the attending ladies were invited to attend the luncheon staged in New Britain by Guggenheim Bros., at which Toastmaster Fred Beile, President of the New York Association, and New Britain officials exchange witticisms and fun-poking comedy.

(*From the above it is to be noted that N.E.S.W.A. has picked a live-wire Secretary-Treasurer to fill the position long held by F. W. Gilcreas, who has been deservedly recognized by being raised to the presidency of the association he has so well served. —Ed.)

Technical Sessions

(President John H. Brooks, Presiding)

The opening paper on the technical program was that by A. F. DAPPERT (past president of N.Y.S.S.W.A.) who reviewed developments in **"The Administration of New York State Requirements Relative to Qualification of Sewage Treatment Plant Operators."**

Mr. Dappert briefly reviewed the new regulations which became effective on October 1st, 1937, involving grading or classification of operators into three grades depending upon the size and type of plants being managed. Grade 1 is required for all operators in charge of any type of plant serving more than 40,000 people, or activated sludge plants serving more than 10,000 people. Grade 3 applies to operators of plants serving less than 10,000 people, with Grade 2 in between. Shift operators are required to qualify in a grade one number below the chief operator or plant superintendent. Grade 1 requirements involve an engineering degree and 1 year of experience, or 2 years of experience in lieu of a degree. Grade 2 requirements involve the taking of special courses at short schools for 2 years, plus 2 years of experience. Grade 3 requirements are 1 year of experience or completion of a 2 weeks' special course, plus 3 months of experience. For the special courses individual tutoring and coaching by consultants may be substituted.

Mr. Dappert stated that to date 120 operators had

Two Secretaries and a President

New England's Secretary—F. W. Gilcreas
New York's Secretary—A. S. Bedell
[*Now don't blame the printer; for further details see page* 1—*par.* 4—*line* 1.]

been definitely graded. Those holding positions at the time of passage of the new regulations were protected by a grandfather-clause, but must qualify before taking a new position in the state. Thirty operators had attended the special two weeks courses held at Cornell; Rensselaer Polytechnic and New York University. An interesting aspect of licensing was the fact that sewage operators were now classed as public-health personnel, alongside of local health-officers or sanitary engineers. Although, the regulations could not prevent an operator from being dropped by the city, such would be less apt to happen when realizing that only a qualified man could be appointed in any replacement. As much had already been proved during the first year of the new regulations.

Warren J. Scott, Chief Engineer, Conn., Dept. of Health, revealed that the N. Y. law was in many respects similar to Connecticut's regulations of 1933, in which State Dept. of Health approval of operators appointed is required. Connecticut had as yet never attempted to grade operators. However, since 1933 there had been no serious displacement of operators in the state. Equally important as technical qualifications, noted Mr. Scott, was the ability of operators to attain harmony, and thus secure cooperation and sympathy from municipal officials. In present day plants mechanical ability appeared the primary requirement for successful operation and maintenance.

Some Fundamentals of the Activated Sludge Process

"Observations on the Effect of Variations in Initial Numbers of Bacteria on the Course of Oxidation of Organic Materials," by C. T. BUTTERFIELD, Principal Bacteriologist, U. S. Public Health Service, Cincinnati, Ohio.

As the title implies, Mr. Butterfield's paper reported results of studies conducted by the Cincinnati Station staff of the U. S. Public Health Service. The observations reveal the importance of balance between organic input, bacterial numbers and oxygen supply at the beginning stages of the activated sludge process. The paper is of a calibre which defies effective coverage in a digest of this nature, without the plotted results the speaker presented in an illuminating series of graphs. The following, however, are briefly the points of emphasis: (1) The rate of oxidation of carbonaceous materials in the activated sludge process is dependent upon the numbers of oxidizing bacteria introduced into the sewage with the returned sludge—i. e., the *initial* numbers; (2) Such bacteria require feeding with organic solids (sewage or waste) within definite limits (avoiding starving or overfeeding), if their vitality and rate of work is to be maintained at greatest efficiencies during the period available in aeration units of economic design; (3) Whereas, the presence of some dissolved oxygen is essential, high concentrations had no added benefit; (4) The degree of dispersion of floc particles, and rate of turnover of sludge, likewise has an important bearing on rates of oxygen utilization and purification.

The findings reveal important fundamentals of the activated sludge process, which bid fair to prove of high importance in plant operation control. Emphasized are such matters as the importance of (1) Minimum delay in getting returned sludge from the final tanks, or the mixed liquor, back to the sewage and air—i.e., food and oxygen supply; (2) Watching sludge activity as an index to numbers and vitality of oxidizing bacteria; (3) A means of taking care of peak loads of sewage in excess of that which may be utilized in sludge (bacteria) feeding—this, in a manner to maintain performance on an even keel with maximum power economy; (4) Distribution of air input into returned sludge and aeration units so as to maintain a positive dissolved oxygen balance, without waste.

In reply to a question, Dr. Butterfield cautioned against increasing sludge return rates with increasing sewage flow because of the dangers of oxygen deficiency from overload. A better scheme would be to divert some of the peak flow to an auxiliary process, such as plain aeration. Underfeeding was a less serious evil than overloading or overfeeding the sludge. To another questioner, Dr. Butterfield said that a milky effluent was usually indicative of suspended bodies of bacteria, which the protozoa had not cleared up. It did not necessarily indicate a less oxidized effluent. It was true that organic adsorption by the sludge floc played an important part in the initial stage of the process for subsequent oxidation.

Asst. City Engr.
W. A. D. Wurts
(Hartford Host)

Plant Supt.
John H. Symanski
(New Britain Host)

Sludge Filtration

"Experiences with Vacuum Filtration of Sludges," by LEROY W. VAN KLEECK, Senior Sanitary Engr., State Dept. of Health, Hartford, Conn.

Mr. Van Kleeck high-lighted his 72 page paper, which proves to be a compendium of information on vacuum filtration of sewage sludges, based on experiences in maintaining and operating such units. Without question the author has brought together more worthy informa-

tion on vacuum filters in sludge dewatering practice than has so far been made available. He set forth 13 reasons why, at all but the largest works, sludge digestion should precede vacuum filtration. Amongst the more important flexibility of operation, safety, overall economy due to reduced chemical consumption, smaller filter area needed (a single unit being permissible), gas utilization, longer filter cloth life, no odor or fly problem. In commenting on sludge conditioning practices, Mr. Van Kleeck said that experience had taught that there was a tendency to mix and hold the coagulated sludge too long, and that transfer pipes of less than 6 in. diameter seemed to shred the sludge clots and reduce filter rates. Conditioned sludge should never be pumped, and that continuous conditioning was preferable to the batch method. In controlling chemical dosage (in conditioning) cent ferric chloride reduced the pH value to between 6.3 and 6.5.

The following table reveals the comparative chemical requirements, yields and moisture content of the cake.

	Pct. $FeCl_3$	Pct. Lime	pH	Cake Yield	Pct. Moisture
Raw solids	5.5	12 to 14	10.5 to 12.0	1.1	69
Chemical Ppt'd...	1.5	12 to 13	9 to 10.5	3.4	74
Digested	2–3	6	10.5	5.6	60
Digested Elutriated	1.75	none	6.3 to 6.5	6.3	63

(WATER WORKS AND SEWERAGE has been fortunate in securing Mr. Van Kleeck as a contributor of a series of articles on the "Practical Aspects of Vacuum Sludge Filtration," the context of which will prove of value to designing engineers, and helpful to plant operators seeking operating economies with maximum filter yields and longer hours of filter cloth life.—Ed.)

Main Meeting Room—Showing About One-Third of the Exhibits

Snapped during the symposium on "The Care and Operation of Mechanical Sewage Equipment." George Gascoigne speaking; Leroy Van Kleeck presiding. (Sparse attendance due to a parallel symposium in another room.)

the Buchner funnel method had been found the best. Rate of filtrate production, its clarity, and dryness of cake, were the best indices. Optimum pH values of filtrate had been found to be 10.5 for digested sludge; for elutriated digested sludge only 8.6 pH. Lime with low magnesia content seemed preferable as a conditioner, and ferric-chloride was the preferred iron salt in the plants studied. Three methods of computing filter yield were outlined, and a specimen filter log accompanies his paper. Operating data from four representative Connecticut plants show results from chemically precipitated solids (Guggenheim Process), raw sludge, digested, and elutriated digested sludge. In the order given, cake yields had averaged 3.4, 1.1, 5.6 and 6.3 lbs. of dry solids per sq. ft. At the Hartford plant no lime had been required with elutriated sludge, and only 1.75 per

Discussion:

G. J. McInerney, Supt. of Treatment Works, Elmira, N. Y., the first scheduled discussor, revealed that at Elmira it had been found helpful and more economical to space the spirally wound cloth wire 3 inches apart instead of 1 inch. Incinerator ash containing 28 per cent calcium oxide had been employed as the source of most of the lime required. In conditioning raw solids 2 per cent ferric chloride and 6 to 8 per cent calcium oxide had been required. Use of incinerator ash had produced excellent filter cake but reduced its volatile content, making necessary the use of auxiliary fuel.

L. L. Luther, Supt. of Sanitation, Freeport, L. I., presented experiences with digested chemically precipitated solids at Freeport. Employing 2 per cent ferric chloride and 8 per cent lime, the filter cake yield (70%

Leroy Van Kleeck, Conn. Dept. Health, Hartford
(New Sec'y-Treas. N. England Assn.)

Wm. P. Petrie, Supt. of Sewerage, Norwalk, Conn.
(Elected to Federation Board of Control)

A. F. Dappert, N. Y. State Dept. of Health, Albany
(Explained New York's Operator Licensing Scheme)

moisture) had averaged 6 lbs. per sq. ft. per hr. From the filter the cake had been converted into a soil builder by passing it through a Royer Sludge Disintegrator, productive of particles of coffee-bean size. Filter-cloth life had averaged 5 months since employing high pressure water wash at the end of each run.

A. L. Genter, Chemical Engineer, Baltimore, Md. (inventor of the elutriation process) stated that vacuum filtration of sludge had established itself on the basis of overall costs. Even at a chemical cost of $1,000.00 per day Chicago had found such to be the case. He pointed out that it could usually be shown that digestion ahead of vacuum filtration paid, particularly when elutriation of the digested sludge was practiced. In sludge conditioning he advocated a rapid short mixing period and immediate filtration thereafter. Faulty conditioning tank and piping arrangements at the Washington, D. C., plant had cost the city $5,000 per year in additional chemical requirement, and slowing of filter rates. For filtering lime-treated sludges the cheapest grades of smooth cotton duck cloths had proved overall best.

L. H. Enslow, stated that high lime treatment had caused calcium carbonate blinding of filter cloths, and also the wire mesh backing. To overcome this condition he directed attention to the use of hexa-meta-phosphate in water treatment to prevent after-depositions of calcium carbonate in piping systems. He believed that adaptation of this material in gas-engine cooling systems, hot water heating systems, and in sludge filtration, offered possibilities of decided interest to sewage operators. Mr. Enslow advocated its trial in sludge filtration, based on experiences in water conditioning to stop precipitation of carbonate of lime.

(The material referred to is being marketed under the trade name "Calgon."—Ed.)

Dr. C. T. Butterfield, U. S. Public Health Service, Cincinnati
(Knows his "bugs"; makes 'em work.)

Geo. B. Gascoigne, Consulting Engr., Cleveland
(Commutes between Cleveland and New York)

Henry Ryan, State Dept. Public Wks., Albany
(Knows sludge pumps; had pump peddlers wondering how much he'd tell.)

The Care and Operation of Mechanical Equipment

(Symposium Director, L. W. Van Kleeck)

An entire afternoon session was given over to four papers and discussion devoted to "The Care and Operation of Mechanical Sewage Plant Equipment." Such proved extremely interesting and valuable to sewage works operators. Simultaneously, in another room was held a symposium devoted to "Public Relation and Public Service," covered later in this report.

"Sludge Incinerators" by GEORGE B. GASCOIGNE Consulting Engr., Cleveland, Ohio.

Mr. Gascoigne briefly outlined the two favored methods of sludge incineration—i.e., the multi-hearth method, developed by Nichols Engineering Co., and the flash-drying method of Combustion Engineers, Inc. He pointed to the remarkable growth of sludge incineration, 21 installations being made within three years following the first successful unit installed at the Dearborn Mich., plant. Largest of the Nichols Multi-Hearth installations was that of 100 ton per day capacity at Cleveland's Southerly Plant. The secrets to the successful operation lay in the effective control of quantity and quality of sludge cake, wherein sludge digestion was a great asset in the production of a dependable continuous rate of sludge cake, and uniformity of the product. The filter operator having done his share, the incinerator operator's job was principally that of watching temperatures, air supply and his draft suppressors. With a dependable supply of cake, temperature control on the various hearths of the Nichols incinerator was simplest attained by varying the rate of filter cake input, plus operation of the auxiliary fuel oil burners to maintain smoke and odor destroying temperatures. From the standpoint of efficiency and costs, the continuity of incinerator operation had proved of highest importance. And the theme-song of the operator should be—(1) Keep an eye on the pyrometers; (2) Keep a clear stack; (3) Watch for "puff-outs"; (4) Watch the cost sheets, for excessive fuel consumption.

R. W. Rowen, Engr., Nichols Engineering Corp., New York City, invited to describe the features of the Nichols incinerator, explained that the upper three hearths were strictly drying hearths. On the 4th, 5th and 6th the combustion takes place, and the 7th and 8th were cooling hearths. With light cake feed the burning zone moved upwards; with heavy feed the reverse. Like Mr. Gascoigne, he was in favor of partial digestion in conjunction with incineration for greater dependability and uniformity of operation.

In reply to questions concerning permissible moisture content of sludge cake, Mr. Gascoigne stated that digested sludge was being successfully burned with 60 to 68 per cent water content. At Cleveland the optimum was at about 70 per cent although they expected to be able to burn a cake with as much as 75 per cent moisture at times. Mr. Rowen explained that the moisture tolerance varied with the content of combustibles. Combustion would be self supporting under the following conditions—(1) 42 per cent combustibles, 67 per cent

(1) New Cannan's (Conn.) "Sir Galahad"—Chester Proudman, Supt. of Sewerage and Treatment; (2) Guggenheim's Lee Williamson, who hails from Virginia; (3) Inertol's "Collar-ad"—Eric Hartmann; (4) "Dorrco's" Wayne Kivell; (5) A big slice of "Dorrco's" brains—"Doc. Tony" Fischer; (6) Chicago Pump's affable "Prexy"—M. I. Weil; (7) Greenwich's (Conn.) Chairman of Sewer Board, W. J. Wilson; (8) Trohn's Sam Barasch who sells "Tapax" et al.; (9) Jos. C. Harding, Consulting Engr., Mt. Kisco, N. Y.; (10) W. & T.'s Veteran Al. Johnstone (his slogan, "For Odor Control—Next to Roses, Chlorine Is Best."

water; (2) 65 per cent combustibles, 72 per cent water.

(The following day members saw a Nichols incinerator in operation at New Britain's Guggenheim plant; took opportunity to ask many more questions.—Ed.)

"Electricity for Sewage Plant Operators," by VICTOR GREIFF, Electrical Engr., Dept. of Public Works, New York City.

Mr. Greiff, in a pleasing manner, tossed his prepared paper aside and spoke intimately on the problems of electrical maintenance and operation in sewage plants. Chief amongst the enemies of electrical equipment in sewage works he listed hydrogen sulphide, extreme humidity, poor ventilation, ammonia, and volatile acids. Attack of copper or brass parts of control panels and switchboards, by sewage gases (especially hydrogen sulphide) had been responsible for arcing of contacts and costly destruction of wiring. A justified expense was that of enclosing such equipment in a room supplied with fresh air. Cadmium plating of all exposed copper parts had also proved helpful. As to motors, slip ring induction motors had been satisfactory up to 4,000 volts, even after submergence. However, the severe storm recently experienced proved one of the best arguments for elevated structures.

In reply to questions, Mr. Greiff suggested that the power factor might be improved by employing synchronous motors on the largest pumps and blowers. As to the practicability of vari-speed motors, Mr. Greiff said that two speed motors had proved quite satisfactory, but he warned against any greater number of speeds. On two speed slip-ring motors there could be expected only a 6 per cent loss in efficiency at the lower speed.

E. W. Luft, Chief Electrical Inspector, New York City, told of the successful use of an electric welding set for passing current through motor coils to raise the temperature and dry them following the recent flood submergence. Moisture had, to his mind, proved the most troublesome element in maintenance of electrical equipment and motors at sewage plants. Water tight cases should be more generally considered for such plants.

"The Care and Operation of Gas Fired Boilers," by HAROLD MASSEY, Manager of Sales, American Gas Products Corp, New York City.

Mr. Massey described the type of gas fired boilers now so widely employed in sewage plants. These, he explained, were of the same basic design as those employed in general building heating. One feature was the draft diverter in the stack, installed to preclude back draft and blowing out of the flame. With the aid of phantom view charts he described the several control and safety devices on American boilers. These included the gas pressure governor and the all important gas throttling valves, to maintain any desired water temperature or steam pressure; the automatic gas shut-off, should pilot flame be extinguished through any cause; the low water cut-off feature, and other less important features.

In discussing operation and maintenance, Mr. Massey stated that the mixture and sulphide and other impurities in sludge gas had proved the source of the chief difficulties. Stack condensation troubles had been corrected by operating water boilers at full rating of 180 deg. F., made possible by practicing bypassing of a portion of the recirculated water. Pilot burner troubles had been eliminated by using already purified city gas. In reply to questions from the floor, Mr. Massey stated that stack temperature, needed to preclude condensation, was 350 deg. F. or higher, the normal being 400 degrees; gas pressure should be not less than 2½ inches of water and the higher the better; the pressure governor should be set for the minimum expected pressure ahead of it; gas scrubbing would reduce many operating difficulties; a switch to manufactured city gas did not entail any change in the gas jet or burners being supplied for sludge gas; city gas was recommended for the pilot principally because of constancy of pressure, fast burning qualities, higher purity.

Ed. Savage Guggenheim Bros. (New Britain Luncheon Host)

Robert Spurr Weston Consulting Engr. (A Gentleman of the Old School)

Mr. Massey pointed out that an ample gas line drip trap of good design was an important unit. It should be located just forward of the gas meter. The float operated P.F.T. trap had been very satisfactory, but for maximum safety it should be drained manually once weekly; especially so in cold weather. In reply to the question—"Did he advocate steam boilers as preferable to hot-water units for sewage plants?"—Mr. Massey stated that the steam units were definitely preferable; especially so for the smaller plants.

"The Performance and Care of Sludge Pumps," by HENRY RYON, Senior Sanitary Engr., New York Dept. of Public Works, Albany, N. Y.

C. Geo. Anderson, Supt. of Sewerage, Rockville Center, L. I.
G. J. McInerney, Supt. Treatment Wks., Elmira, N. Y.
J. W. Van Atta, Ralph B. Carter Co., New York City

Mr. Ryon's long observations, and varied experience with sludge pumping, made possible his valuable contribution which he dubbed a "Memorandum on Sludge Pumping." In comparing pumps of the displacement type with those of centrifugal design, he cited the advantages of each for specific purposes. In small installations the displacement pump had certain advantages over the centrifugal type, such as ease of priming and ability to pump smaller quantities more successfully.

Concerning displacement pumps, Mr. Ryon made the following comments on transmission features. For smooth running it seemed best to keep the speed of the main pump-shaft below about 35 r.p.m., and piston speeds under 30 ft./min. Frequency of reversals were more important than speed in sludge pumping. For changing pumping rates, variable speed transmissions had proved superior to changes of piston stroke. Too short strokes produced less smooth and less efficient operations. Displacement pump packing had been one of the most frequent causes of troubles. Four to six rings of square braided flax packing had proved satisfactory, the graphited variety being best where infrequent operation is involved. Rawhide packing had certain advantages too. In cutting packing the use of a template was advocated, in order to provide more exact and uniform fit of all rings. Packing should be kept adequately lubricated, a fairly heavy oil such as "500 W" or "Marine Pump Oil" being preferable.

Concerning valves, the ball-type seemed on the whole preferred by operators. Of the flap valves those of rubber, with rubber hinges, give the least difficulties from cloggages. Mr. Ryon stressed the fact that the quality of the rubber covering on the metal core of valve-ball was of high importance, along with weight and balance, if valve slam or one sided ball wear was to be avoided.

Knocking or pounding, due to reversal of stresses set up with start and stop of flow (stroke reversals) is best alleviated by providing an ample capacity air cushion chamber on the discharge line. Further improvement results from such a chamber on the suction line also. One make of pump comes provided with an adjustable air inlet on the suction side, which had enhanced smooth operation if properly set.

The smallest satisfactory centrifugals had been 4 in., end suction units to handle not less than 50 g.p.m. To vary output, the most practical scheme had proved to be use of a vari-speed transmission, pump throttling being absolutely impractical. Effective priming was another problem with centrifugals, where located so as to entail a suction lift.

Mr. Ryon in commenting on a centrifugal of special design, to cut up clogging materials and force sludge to the pump impeller proper (known as the "Scrupeller Pump"), stated that it had proved generally satisfactory for crude sludge.

J. W. Van Atta (Ralph B. Carter Co.), asked to explain the intake sniff-valve for admitting air under the ball valves, to cushion the reverse impact and lessen hammering, did so.

S. E. Kappe (Chicago Pump Co.) in presenting some useful hints in design and maintenance, stressed the fact that economy in the latter hinged on thought given the first. He emphasized the value of self-cleansing velocities in suction lines, the length of which had been in inverse proportion to troubles encountered. For happiest operator-designer relations a positive head on sludge pumps was advocated as a No. 1 consideration.

J. K. Merwin (Chain Belt Co.) in discussing changing speeds vs. piston stroke, for varying pumping rates, supported Mr. Ryon's recommendations that shaft speed change was the proper method. As to packing, he endorsed that sold by the Linear Packing & Rubber Co. of Tacony, Pa., as the best tried. It cost twice as much but lasted at least twice as long. On plunger type pumps, he preferred slight suction head to a positive head. The result was better valve operation and less noise.

Paul J. Cerny (Pacific Flush Tank Co.) agreed concerning the desirability of a slight suction lift. He advocated shaft speed changes between 35 and 40 r.p.m., delivering a maximum of 60 g.p.m. of sludge per unit. He formed an air chamber on suction side of plunger pumps, and sludge thinning when required. Making of sludge pumps dewatering units had caused many a headache.

F. F. Tentschert (The Dorr Co.) stated that the value of time clock program operation in pumping sludge to digesters had been overlooked to too great a degree. Where employed, the result had been a better clarifier condition, more even gas production, less disturbance of digesters, thicker sludge on the average. The latter meant less power cost per ton of solids handled. The cost of such program clocks ran between $50 and $100.

Public Relations and Public Service

(Symposium Director, Morris M. Cohn)

"Publicity—Selling the Idea", by GUY E. GRIFFIN, Supervising Engr. Sewer Commission, Greenwich, Conn.

Said Mr. Griffin: To sell the idea of sewage treatment to the public, the engineer or operator must first know what he has to sell. Is it better operation, an improvement to the plant, or even a new plant? Whatever it

Harold Massey, American Gas Products Co., New York
Robt. W. Rowen, Nichols Eng. & Res. Corpn., New York
Paul J. Cerny, Pacific Flush Tank Co., New York

(1) Ralph C. Sweeney, N. Y. State Dept. Health, Albany, and Edw. A. Dyer, Supt. Water & Sewers, Cobleskill, N. Y.; (2) A. L. Genter explaining the sludge elutriation system to a group at the Hartford plant; (3) Supt. John Szymanski at New Britain's plant being "cross-questioned" by Frank Roe concerning "Aloxite" tube service, and by Ward Pitkin concerning Oliver Filter performance at New Britain; (4) Bio-Chemical aeration units at New Britain; (5) G. L. Waldron, Supt., and R. H. Albrecht, Engr. of Water Works and Sewerage, Hamilton, N. Y.

may be the advantages and costs must be thoroughly understood in order to have ready answers to questions as well as to foresee criticism which may arise. Public interest in the plant may be stimulated by intelligent use of newspaper publicity, of lectures and demonstrations to various interested municipal groups, and through arrangements for organizations to visit the plant. Familiarizing individuals, luncheon clubs, and school classes with the process of sewage treatment establishes a firm basis of public relations.

Mr. Griffin offered four cardinal rules for the presentation of publicity: (1) Know what you have to sell; (2) Know your customers; (3) Employ several methods of approach; (4) Be courteous and make the facts understandable.

Mr. Cohn pointed to the value of attracting public interest and attention even if exaggeration of local conditions is necessary to accomplish this.

"Plant Upkeep," by C. GEORGE ANDERSON, Supt. of Sewers, Rockville Center, N. Y.

Care of structures as well as maintenance of mechanical equipment results in the saving of time and money. Such economy constitutes service which should be expected by the public. Beautification of the buildings and grounds, however, contributes much to public relations.

As an illustration of what may be done in this direction, Mr. Anderson described how a sequence of flowers and proper selection of ornamental shrubs could be employed. Oftentimes most helpful suggestions will come from plant personnel which has been properly trained and instilled with a cooperative spirit.

M. W. Tatlock (Supt. Sewage Treatment, Dayton, O.) commented upon the large-scale civic relations accomplished in Dayton through development of sewage plant environs. The city purchased 500 acres of ground for the plant site, and 160 acres have been used for a public golf course. The land includes both hill and level sections, in which has been located the prize fish farm of the state visited by as many as 850 citizens on one Sunday.

"Odor Control," by H. A. FABER, Research Chemist, The Chlorine Institute, Inc., New York.

The best sewage plant upkeep and operation is appreciated only if good public relations are maintained at the same time. Odors are too readily understandable to the public, and it is the absence of odors which must be sold to the layman. As in the practice of modern medicine, there are two broad methods of odor control, preventative and curative.

Carrying out this similarity, it was shown that such methods as isolation, immunization, prophylaxis, and hospitalization may all be used effectively. Isolation of the treatment plant is no longer desirable and is often impossible. Sewage may, however, be immunized against producing odors either by proper design of the sewerage system and treatment plant or by upsewer chlorination, the purpose throughout being to maintain a stable or nonseptic sewage. Odor control through prophylactic treatment may be accomplished by sewer flushing, prechlorination, or treatment with ferrous chloride—all proving effective when there is no way to prevent septic sewage reaching the plant.

By hospitalization was meant the scrupulous plant cleanliness necessary to prevent odors during the treatment process. In addition, a neat and attractive plant does impress observers as a plant free from objectionable odors.

"Sewer Connections, Limitations, and Financing," by R. C. SWEENEY, District Engr., N. Y. State Dept. Health, Albany, N. Y.

A municipal sewer system and sewage treatment plant should properly be considered as a public utility. As such, it should be ready to supply all desired information to new customers, since this is the first point of contact.

Definite and specific limitations should be set up as to wastes which will be accepted. Mr. Sweeney was of the opinion that there were definite advantages in handling industrial wastes at the municipal plant, if at all possible to do so.

Using utilities as a model, financing may best be through a charge on the basis of service rendered. This method tends to produce adequate funds for proper operation and maintenance of the plant and sewer system. Many states already have laws directed to the establishment of a rate basis. A survey of methods adopted to fix rates produced replies from 206 municipalities located in 32 states. In order of importance, methods employed are: (1) On metered water basis; (2) Flat rate basis; (3) Flat rate on number of fixtures basis. The first of these the author believes to be the fairest method.

Harold L. Brigham, Supt. Water and Sewage, Marlboro, Mass., discussed the manner in which water and sewerage departments interlocked in Marlboro. Sewer connections are laid to houses with the advice of the water department, which then has knowledge of their location. Marlboro sewage rates are on a metered water basis and regarded as fair to all.

"Operation Reports," by S. T. BARKER, Asst. Engr., N. Y. State Dept. Health, Albany, N. Y.

The necessity and value of plant operation reports was well set forth in this paper. Records must necessarily precede reports and should include essential data such as: a diary, power consumption, materials and chemicals used, treatment accomplishments, and stream conditions above and below the treatment works.

Citing reports on plant operation submitted in the yearly competition sponsored by the N. Y. association, Mr. Barker illustrated the value of the report form outlined by the Rating Committee. Monthly assembly of

Harry A. Faber, The Chlorine Institute, New York

Guy E. Griffin, Supervising Sewerage Engr., Greenwich, Conn.

D. W. Carmichael, Borough Engr., Hawthorne, N. J.

data, required records, and the preparation of an annual report has, in a number of instances, caused operator recognition, or increases in salary. Such have always contributed to the information of the operator.

"Sewer Maintenance," by JOHN H. BROOKS, Supt. of Sewers, Worcester, Mass.

Mr. Brooks in discussing construction and maintenance features of separate, combined, and surface types of sewers, said that efficient maintenance requires continuous attention if public satisfaction is to be accomplished. It was essential to have complete and readily available reference data on the sewer system. Preferably, this should be detailed on plans and maps. The provision of a special crew and equipment for maintenance and emergency work will be of greatest advantage. Maintenance is a never-ending problem, but an important principle is to give the public prompt service on complaints of any size. Such service had resulted in favorable publicity and in securing needed funds.

In storm emergencies, immediate action should be taken toward releasing stopped manholes. Obsolescence of manholes is a frequent source of complaint and the correction of banging covers will make many friends.

Geo. Anderson spoke of the convenience of flexible steel sewer rods for cleaning stopped sewers, and satisfaction from use of commercially available material to prevent manhole-lid rattle.

Plant Inspection Day

The second day of the meeting began with the Breakfast Session which was followed by a tour of inspection to the Hartford and the New Britain Treatment Plants.

The usual Question Box and Round Table of the Breakfast Session was dispensed with in order to listen to a description of the new Hartford plant which was presented by W. A. D. Wurts, Asst. City Engr. of Hartford, who served as Engineer in charge of design and construction of the plant which serves an 175 mile combined system, providing primary treatment of flows up to 39 m.g.d. and a population of 200,000. Unique features of the plant include diffused air aeration of influent channels to setting units, for "14 reasons" cited by Mr. Wurts. The cluster of four circular digesters, with fixed dome roofs, are built completely out of ground. The side walls are insulated with three layers of aluminum foil, behind wire lathing covered with a shell of cement mortar applied with a gun. The roofs are cork insulated and the water seals are located inside of the digesters. Flame traps are of the dry type, and heating units consist of low pressure steam boilers.

One of the most interesting features of the plant is the sludge handling scheme. Such involves use of the Genter Elutriation Process (two stage counter flow), conditioning of the washed digested sludge with ferric chloride alone (1.6%) and filter yields of 7 lbs./sq. ft./hr. on Oliver Vacuum Filters. (The sludge conditioning and flocculating tanks of special design have been particularly effective and will be described in a special article by Mr. Wurts which is to appear in this magazine.—Ed.)

At New Britain

From the Hartford plant members and guests proceeded by automobile caravan to New Britain, to luncheon at Hotel Burritt as guests of Guggenheim Bros., to hear New Britain officials praise the builders of their unique bio-chemical plant; and, Supt. John R. Szymanski and others, responsible for its performance which had exceeded guarantees of the contractors.

Following luncheon the afternoon was spent inspecting the plant which makes use of the Guggenheim process combining inexpensive bio-flocculation with assisting chemical precipitation, sludge dewatering on Oliver vacuum filters and incineration in a Nichols multi-hearth furnace. Records reveal an average monthly present cost of between $14.50 and $16.50 per m.g. for maintenance and operation, involving an average iron dosage (chlorinated copperas) of 5 p.p.m. and 0.10 to 0.15 cu. ft. of air per gallon applied to produce effluents with a residual B.O.D. of 35 to 50 p.p.m.

Exhibitors

The following 27 firms were "amongst those present." Their exhibits seemed exceptionally well done this year, in the direction of instinctiveness combined with eye appeal.

Activated Alum Corp., Baltimore, Md.
American Brass Co., Waterbury, Conn.
American Gas Products Corp., New York, N. Y.
The American City Magazine, The Municipal Index, New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Ralph B. Carter Co., New York, N. Y.
Chain Belt Co., Milwaukee, Wis.
The Dorr Co., Inc., New York, N. Y.
Flexible Sewer-Rod Equipment Co., Los Angeles, Calif.
General Electric Co., Schenectady, N. Y.
Hardinge Co., York, Pa.
Inertol Company, Inc., Chicago, Ill.
Johns-Manville Sales Corp., New York, N. Y.
Laboratory Furniture Co., Long Island City, N. Y.
Lockjoint Pipe Co., Ampere, N. J.
Municipal Sanitation, New York, N. Y.
Public Works Magazine, New York, N. Y.
The Pardee Engineering Co., Long Island City, N. Y.
Pittsburgh Equitable Meter Company, Pittsburgh, Pa.
Robinson Clay Products Co., New York, N. Y.
Trohn's Supplies, Inc., Mamaroneck, N. Y.
U. S. Pipe & Foundry Co., Burlington, N. J.
Wailes Dove-Hermiston Corp., New York, N. Y.
W. & L. E. Gurley, Troy, N. Y.
Wallace & Tiernan Co., Inc., Newark, N. J.
Water Works & Sewerage, Chicago, Ill.
Yoeman Brothers Co., Chicago, Ill.

MANGANESE AND IRON DEPOSITIONS

*A Study of the Effect of Treatment on Quality, Quantity and Behavior of Coatings on Sand and Anthrafilt Grains**

By R. B. ADAMS
Chemist, Pennsylvania Water Co., Wilkinsburg, Pa.

The Author

IN 1910 the Pennsylvania Water Company, located at Wilkinsburg, Pennsylvania, completed the construction of a rapid sand filtration plant. The pumping station was located at Nadine, Pennsylvania, and the source of supply was the Allegheny River. Two large filter cribs had been built in the river bed some years previous to this date. The supply used at the plant consists of part raw river water, part filter crib water, and some ground water. The exact proportions of these are not known.

After a few months operation of the new plant, manganese deposits were found on the gravel of the rapid sand filters, and from that time until 1930, many filters were rebuilt as a result of this troublesome element.

Raw Water Characteristics

The Allegheny River, since 1910, has shown a marked decrease in alkalinity[1] due to industrial and mine wastes. The river is not constantly acid; normally it is an alkaline stream with sudden increases in acidity occurring usually in the Summer or early Fall, and lasting about three months of each year. It has been found that manganese is usually present in greater amounts during the acid season.

Table 1 shows the annual average results of the raw water from the years 1931-37 inclusive. The alkalinity of our mixed waters is generally higher than that of the raw river water, but it changes in proportion to the change in the river.

For example, 1934 was our most acid year; the average alkalinity during this year on the raw water was 7.8, while on the river water it was 0.3 p.p.m. The difference or 7.5 p.p.m. was the amount of alkalinity obtained from the ground water.

TABLE 1
RAW WATER CHARACTERISTICS 1931-37.
Parts per Million.

Year	Tur.	Color	Alk.**	Acidity	pH	Hardness	Fe	Mn
1931....	50.	5.8	11.	9.5	6.1	126.	1.2	.66
1932....	42.	6.6	12.	8.2	6.2	128.	1.8	.62
1933....	70.	4.7	9.4	13.	5.8	116.	2.3	.94
1934....	48.	3.2	7.8	15.	5.7	119.	3.3	1.1
1935....	56.	5.8	12.	10.	6.1	108.	2.4	.80
1936....	48.	5.8	12.	10.	6.1	112.	2.4	.91
1937....	78.	9.4	19.	6.6	6.4	111.	0.9	.40

**Methyl orange alkalinity.*

Treatment Used on Supply

The treatment used on the supply ever since 1910 has been alum and lime. Alum coagulates most efficiently on this water at a pH of 6.8 to 7.0, and the reaction is usually carried at this point. During acid spells, or when the pH of the raw water is below 5.5, only lime is necessary in coagulation. Figure 1 is a flow sheet of the treatment plant.

Iron is ordinarily removed without difficulty as long as the pH in the mixing troughs and sedimentation basins is held above 6.8. Occasionally a pH of 7.4 is necessary for good removal.

Manganese, on the other hand, requires much higher alkalinities for precipitation than iron. It is necessary to carry 2 or 3 p.p.m. of caustic alkalinity to completely precipitate manganese, unless an oxidizing reagent is used. Chlorine and potassium permanganate were tried in this connection, but were unsuccessful because of tastes and odors. Manganese removal, on the regular

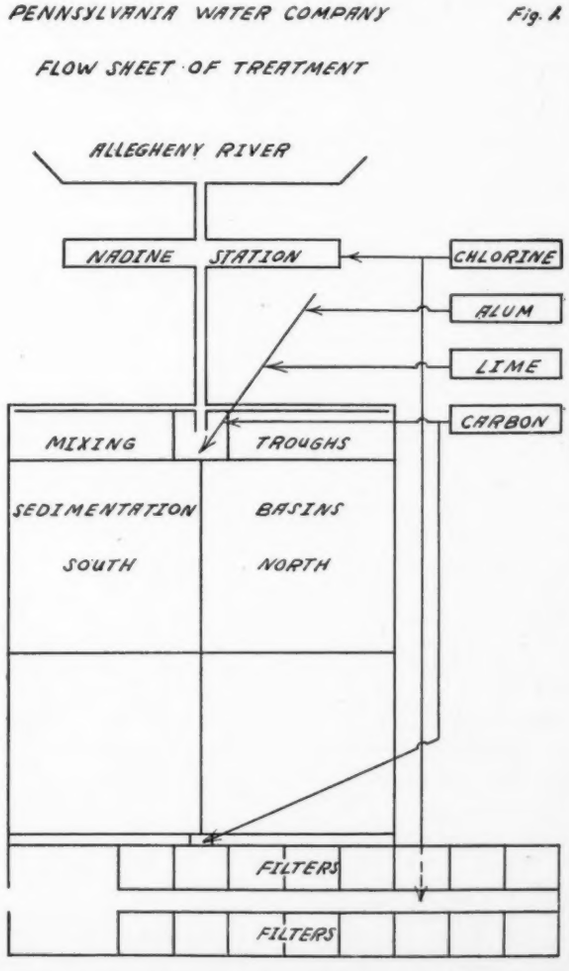


Fig. 1—Diagrammatic Flow Sheet of Treatment.

*A paper presented before the Central States Section of the American Water Works Association. Published by permission of the Secretary and Editor of A. W. W. A.

alum and lime treatment as described above, is about 25 per cent. Of this 15 per cent is removed in the sedimentation basins, and 10 per cent through the filters.

Filters

There are 16 one million gallon rapid sand filters. Ten of these are what we term shallow filters, the other 6, deep ones. They are all equipped with the Leopold concrete block under drain system and are back-washed at

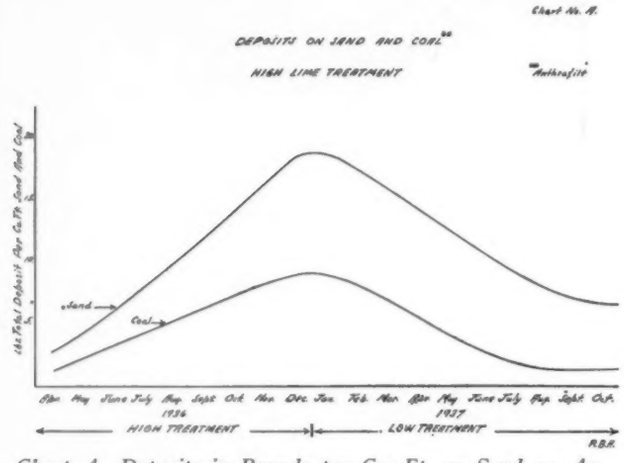


Chart A—Deposits in Pounds per Cu. Ft. on Sand vs. Anthrafilt. Followed by Rate of Disappearance During Normal Treatment.

a 24-in. rise per minute rate. The shallow filters contain about 11 in. of gravel, 20 in. of sand, and have a 17-in. freeboard. The deep filters contain about 30 in. of gravel and 25 in. of sand with a 25-in. freeboard. In 1930, the effective size of the sand in the shallow filters was about .55 mm. One of the deep filters had a .55 mm. sand, while the remaining 5 deep filters had a .45 mm. sand.

In 1935, we replaced one of the deep sand filters with anthrafilt. This unit was made up as follows:

10 in.—1 in. size gravel.
4 in.—Buckwheat coal (through 9/16 and over 5/16).
6 in.—Rice coal (through 5/16 and over 3/16).
34 in.—Anthrafilt.

Treatment for Manganese Deposits

With increasing amounts of manganese in the raw water during the years 1933 and '34, manganese deposits on the gravel beds of our filters became serious. Deposits of this element cemented the gravel to such an extent that wash water distribution was very poor.

Our first procedure in loosening the gravel beds was to use a special longhandled rake, which was pushed down into the gravel while the filter was being washed. The shallow beds reacted well to this procedure. Manganese still deposited on the shallow gravel beds, but hard spots could be kept loosened with the rake. The deep filters contained so much gravel that it was impossible to remove the hard spots by raking.

Our next step was to try a caustic soda treatment. The shallow filters were treated in place with a 1 per cent caustic soda solution; the caustic loosened the deposits from the gravel and set free large particles of manganese dioxide, which were washed from the bed. This treatment did an excellent job on the shallow filters; the gravel was loose and clean, the sand, which was coated with a reddish-brown deposit was also well cleaned. The gravel in the deep filters was too badly coated to treat the entire bed in place, so the sand was removed and the gravel treated with a 1 per cent caustic soda solution. Using this procedure, the deep gravel beds were loosened, but they could not be washed as clean as the shallow ones. After the sand was returned to the deep filters, and the units placed in operation, each filter wash would show a small amount of manganese dioxide scattered over the top of the sand. It was not being deposited but simply being washed from the gravel. Once a week for several months, this material was removed from the top of the sand. By repeating the caustic soda treatment on both shallow and deep filters in place, once yearly, troublesome manganese deposits were reduced to a minimum.

A number of plants have reduced the coatings on their sand and gravel by using the caustic treatment. Our experiences indicate that it is much less effective if carbonates are present to any extent.

Priester[2] has reported excellent results with chlorine in removing manganese deposits from both gravel and sand. Others have used chlorine successfully in treating manganese and iron deposits on sand. Patrick[3] has reported several instances where sulphur dioxide has been used in cleaning deposits of this nature.

Manganese Removal by High Lime Treatment

In 1935, manganese was present in large amounts during hot weather, and complaints concerning manganese stains in the laundry and on bath room fixtures were numerous. In 1936, we decided to use a high lime treatment for a time to relieve this condition, and at the same time to study the deposits which built up on the filter beds, in the absence of recarbonation.

The high lime treatment to be studied actually is a split treatment and does involve some recarbonation. Referring to figure 1, the North sedimentation basin was treated as in the past with alum and lime, and maintained at a pH of 7.0 to 7.2. The South sedimentation

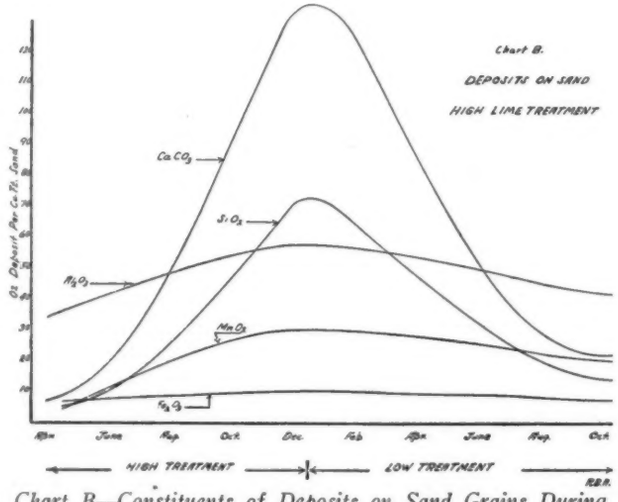


Chart B—Constituents of Deposits on Sand Grains During Coating and Removal Periods.

basin was treated with lime alone in sufficient amounts to produce hydroxide alkalinity of 2 to 4 p.p.m. The pH at this point ran 9.4 to 9.6. The two differently treated waters passed across their respective basins and were mixed just before going to the filters. The resulting water had a pH of about 9.0; at this point it is buffered. In passing through the filters, the pH of the water was reduced to about 8.6.

TABLE 2
MANGANESE REMOVAL BY HIGH LIME TREATMENT
(April 16, 1936, to January 1, 1937)

	Raw	S. Basin Settled	N. Basin Settled	Top of Filters	Filtered
Turbidity	28.	18.	7.8	12.	0.2
Color	5.0	3.8	1.6	2.7	0.2
Acidity	8.8	...	3.0	...	...
Alkalinity Ph.	...	16.	...	8.0	4.0
Alkalinity M.O.	12.	31.	23.	27.	23.
pH	6.1	9.5	7.2	8.9	8.6
Hardness	122.	....	....	....	143.
Iron	1.1	0.6	0.4	.03**	.08
Manganese	1.1	0.4	0.7	.15**	.03

**In solution.

The high lime treatment was started in April, 1936, and continued until January 1, 1937. Table 2 illustrates the type of raw water handled during the high treatment and results obtained. The high treatment removed 97.3 per cent of the manganese.

Study of Deposits on Sand vs. Anthrafilt

Under these given conditions, it is interesting to study the deposits which built up on the filter beds. The sand and coal first showed signs of coating at the end of two months' high treatment. Manganese deposits were evident and laboratory tests indicated the presence of carbonates. At the end of three months, it was found that the filters were not coating the same. All ten shallow filters, having the coarser sand, were coating evenly to the gravel, but not on the gravel. The deep anthrafilt filter and one of the deep sand filters (Filter No. 14 which had a .55 m.m. sand at start of high treatment) were also coating to the gravel. The other four deep sand filters were coating only about 3 to 4 in. down from the surface of the sand. Throughout the high treatment, the filters continued to take on deposits in the above manner.

Upon examining the four deep sand filters which coated to a depth of but 3 to 4 in., we found only the fine particles of sand coated. In other words, the fine

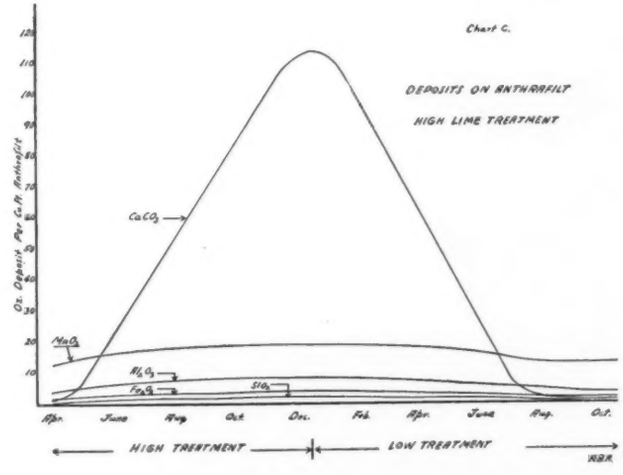


Chart C—Constituents of Deposits on Anthrafilt Grains During Coating and Removal Periods.

grains of sand coated first, remained on the surface of the filter, and acted somewhat as a protective mat for the filter. There was no manganese or iron depositing below this mat and only a small amount of lime. One sample of the finest sand taken from the surface of one of these filters had an effective size of .25 mm. It was very difficult to keep these four filters free of mudballs while using the high treatment.

The one deep sand filter which coated to the gravel had only 1 inch of protective mat, and the coated sand in this mat was coarser than that found on the other deep filters.

From these observations, it appears that the effective size and character of the filtering material may be important when considering the extent to which a filter bed may take on deposits with this type of high lime split treatment.

Deposits Redissolved by Low pH Treatment

On January 1, 1937, the high lime treatment was discontinued and the plant placed on the regular alum and

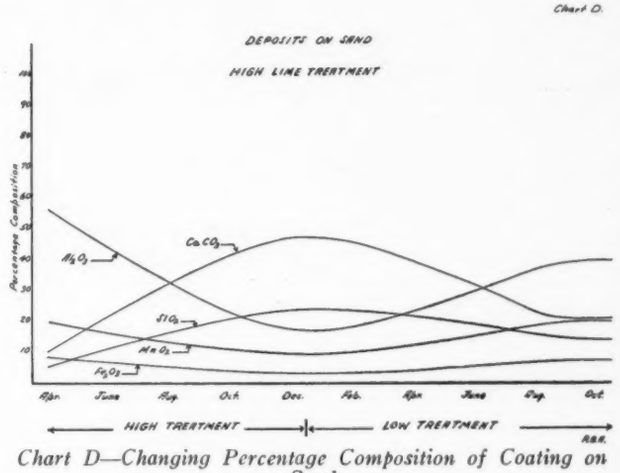


Chart D—Changing Percentage Composition of Coating on Sand.

lime treatment, with coagulation taking place at a pH of 7.0. Manganese in the raw water was running low at this time, therefore, we considered it a good opportunity to see how much of the deposit which had built on sand and coal could be removed by the lower pH treatment.

In making a detailed study of the deposits on sand and coal, we had originally planned to use one of the deep sand filters for a comparison; but due to the formation of a protective mat of fine coated sand on the deep units, and the resulting varying conditions, we decided to choose a shallow filter. As stated previously, all the shallow filters coated in a manner similar to the deep anthrafilt unit. All samples for this comparison were collected at a depth of 10 in. below the surface of the filter.

Chart A shows the total pounds of deposit which built up on a cubic foot of sand and anthrafilt throughout eight months of high lime treatment, and the extent to which these deposits redissolved upon returning to a pH treatment of 7.0. At the end of the high treatment, sand had taken on 16 pounds of deposit per cubic foot, while anthrafilt had taken on 7.75 pounds per cubic foot. The anthrafilt filter returned to its original condition, with the exception of a small percentage of manganese, in eight months' time. The sand did not return to its original condition; only 76.5 per cent of the deposit was removed, and this required a 10-month period.

TABLE 3
DEPOSIT ON SAND

	Total Ounces Deposited per Cu. Ft. Sand	% Removal by Low pH Treatment
Fe_2O_3	3.0	100.
$CaCO_3$	128.	88.3
SiO_2	67.5	81.6
Al_2O_3	23.5	70.2
MnO_2	26.0	38.4

Chart B shows the ounces of $CaCO_3$, SiO_2, Al_2O_3, MnO_2, and Fe_2O_3 in the coating of a cubic foot of sand throughout the period of high and low treatment. Table 3 shows the maximum ounces of the various compounds which deposited on a cubic foot of sand, and the percentage removal of these compounds by the low pH treatment.

Chart C shows the ounces of $CaCO_3$, SiO_2, Al_2O_3, MnO_2, and Fe_2O_3 in the coating of a cubic foot of anthrafilt throughout the period of high and low treatment. Table 4 shows the maximum ounces of the various compounds which deposited on a cubic foot of anthrafilt, and their percentage removal by the low pH treatment.

TABLE 4

DEPOSIT ON ANTHRAFILT

	Total Ounces Deposited per Cu. Ft. Coal	% Removal by Low pH Treatment
Fe_2O_3	2.2	100.
$CaCO_3$	113.	100.
SiO_2	1.6	100.
Al_2O_3	4.7	100.
MnO_2	6.5	92.5

Charts D and E show the percentage composition of the coating on sand and anthrafilt respectively at any time during the high or low treatment. It is interesting to note that in the sand coating at the beginning of the high treatment manganese was present in the amount of 20 per cent and at the end of the redissolving period it still ran the same. The sand was originally reddish-brown

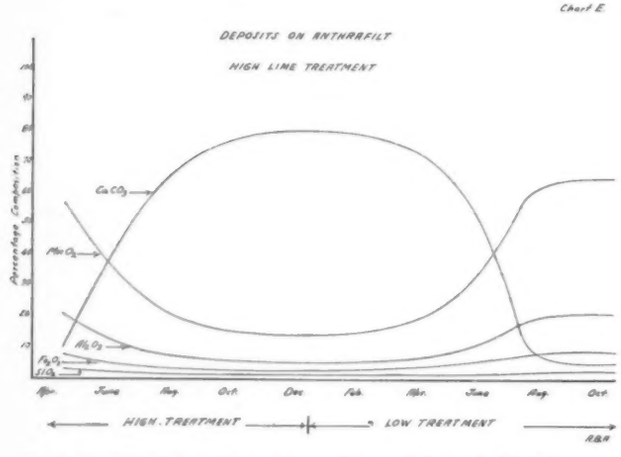


Chart E—Changing Percentage Composition of Coating on Anthrafilt. (Note the marked difference in silica and alumina on sand vs. anthrafilt grains. Also, the difference in the manganese curve for the two materials.)

in color, and at the end of the redissolving period it was black, yet the same percentage of manganese was present. This indicates a change to a higher valence manganese. And, since the higher valence manganese has been present, our gravel beds have no longer been coated with manganese. They are gradually becoming cleaner as they are washed. Thus is indicated the probable value of oxidation of manganese to prevent grain coating.

SUMMARY

1. A 1% caustic soda solution was effective in removing manganese coatings from gravel beds of rapid sand filters; also, alumina and iron coatings from sand.

2. A high lime treatment for manganese removal built up deposits on both sand and anthrafilt.

3. The manner in which a sand filter coated with deposits depended upon the effective size of the sand.

4. At the end of eight months high lime treatment, a sand filter which had an effective size of .55 mm. at the beginning of the treatment, took on 16 pounds of deposit per cubic foot. Under similar conditions, a .70 mm. anthrafilt unit took on only 7.75 pounds of deposit per cubic foot.

5. Deposit on sand was removed to the extent of 76.5% by the low treatment, while over 99% of the deposit on anthrafilt was removed in the same manner.

6. Iron was low in both sand and anthrafilt coatings. Silica ran high in the sand coating but very low in the anthrafilt coating. Alumina and manganese both ran considerably higher in total deposit on the sand than on the anthrafilt. Calcium carbonate deposited heavily on both sand and anthrafilt, the amount building up on anthrafilt being 88% of that which built up on the sand.

7. Manganese dioxide depositing on the sand grains is helpful in preventing similar deposits from cementing the gravel beds.

REFERENCES

1. C. F. Drake, Water Purification Problems in Mining and Manufacturing Districts. Jour. A.W.W.A. 23: 1261 (1931).
2. Max U. Priester, Reconditioning Filters, W. Wks. and Sew. 81: 48 (1934).
3. J. G. Patrick, Cleaning Filters With Sulphur Dioxide, W. Wks. and Sew. 85: 90 (1938).

MANUAL OF WATER WORKS ACCOUNTING READY FOR DISTRIBUTION

The new **"Manual of Water Works Accounting"** is now ready for distribution by the American Water Works Association and the Municipal Finance Officers Association.

This useful guide for water works managers and superintendents, representing a joint production of the two distributing associations, was designed to fill a long felt need for an authoritative reference publication devoted specifically to methods, procedures and mechanical details of accounting practices in water works operation.

The work of producing the new Manual was carried on by committees of the two associations, Hal F. Smith of Detroit being Chairman of the A.W.W.A. Committee. To speed the work, a full time technical staff was set up for the purpose. After several reviews and revisions the final draft was approved by the two associations, and now the finished product has just come from the press.

The manual is divided into five main sections as follows:

Part I—A general discussion of accounting systems and organization.

Part II—Customer (income) accounting, billing and collection procedures.

Part III—Accounting for expenditures of all sorts including payrolls.

Part IV—Accounting for assets, investments, liabilities, net worth.

Part V—Financial planning—statements, budget making and execution.

The manual is effectively illustrated with specimens of record and accounting forms, considered to be the most useful and practical in use. Of extreme value to water managers, far and near and little and big, are the chapters dealing with billing and collection procedures.

The new manual has been designed to bring better business methods into publicly owned water works; also to make for greater uniformity in methods and procedures of accounting. Particularly, too, to assist superintendents of the smaller systems, with their "Politico-financial" problems.

To all who have the responsibility of water works accounting, it would seem that the new manual may well prove next to indispensable. The price is $4.00 (to members of either association $3.20) and it may be ordered from The American Water Works Association, 22 East 40th Street, New York City; or The Municipal Finance Officers Association, 1513 E. 60th St., Chicago, Illinois.

HOW MUCH DOES IT COST TO MAKE A MAIN EXTENSION?

An Open Letter from One Superintendent to Another

By D. R. TAYLOR

Plant Supt., Water Department, Roanoke, Va.

Here is an opening "letter" of a series of such letters—"From One Superintendent to Another."

Knowing of the several useful "kinks and gadgets" developed by Mr. Taylor, and members of his organization in the Roanoke, Va., Water Department, we have persuaded the author to pass on to our readers such useful and valuable information as this first contribution represents.

The easy and friendly style of presentation, in the form of "open letters from one Super. to another," originates with the author. This folksy "exchange of ideas" is pleasing to us, and we know that our subscribers will find much worth reading in "Doc" Taylor's series of forthcoming "Tom to Bill" letters.

And, says "Doc"—and says US—it will be appreciated if some of the "Bills" reciprocate by submitting an open letter to "Tom" occasionally. This method of "exchanging ideas" is a happy one—so let's have some "Bill to Tom" letters also.—Ed.

"Doc" Taylor

DEAR BILL:

I certainly enjoy exchanging ideas with you. It just seems to me that regardless of what a fellow wants to eat, drink, wear, build or buy, it is always the same question, "How much does it cost?"

Bill, in all my water works experience I have been met in various places away from the office by customers who were considering everything, from laying a piece of pipe from the spring down to the house on their farm in the country, to developing new residential sections in or near our city. And, all of them wanted to know, "What will it cost me to lay such and such size pipe?"

When a fellow meets you on the street and says, "What will it cost me to put water mains in that development of mine in the Fairview Addition," now Bill you know he might as well ask you "how high is up," as to ask you that question without any facts having been given in that one interrogation. You finally pry out of him the length of his proposed extension and then he doesn't know whether he wishes to lay 2, 4, 6 in. or what size of pipe; so, he says "what would you lay?" Well Bill, after you explain to him that it depends upon whether he wishes to give the barest domestic needs or install a real system that will meet the approval of the National Board of Underwriters, he decides he would like to have the probable cost of both. Before he gets through he has asked you for the detailed cost of every individual item, going into the construction of several sizes of mains, as for instance, the cost of pipe alone, joint material, labor for laying the pipe, labor for backfilling it, etc.

You know, Bill, years ago I heard about a fellow that worked for a railway and his job was to meet trains when they came into the passenger station and walk along on each side of each coach and tap the end of each journal box with a hammer. A customer, who had bought a ticket and was waiting for his train, saw this fellow perform his duty one morning and watched him very curiously. Finally the customer walked up to him and said, "Pardon me, Buddy, but how long have you been on this job?" The fellow replied, "Thirty years." The customer said, "Have you been hitting those bearings with that hammer that long?" The fellow said, "I sure have." The customer said, "Well, tell me, why do you hit those bearings with that hammer?" The fellow replied, "I be derned if I know."

Bill, you know that fellow made an impression on that customer, but it was the wrong kind of impression. Ever since I heard that story I have felt that it pays to know at least the majority of the answers, consequently the more of these questions I was asked about main extensions, the more anxious I was to be able to answer most of them out on the street; so, Bill, I sat down at home for a few nights and prepared a tabulated estimate of the cost of mains per foot. I checked these costs with the various actual costs that we have experienced over many years and finally arrived at the average figures, which I believe will answer 99 and 44/100ths of the questions that you and I are asked about main extensions.

Bill, I am enclosing a copy of this estimate sheet, because I thought you might have some use for it in your town. You may, of course, have to revise some of the figures, depending upon your labor conditions, your wage scale and your overhead. And, of course, the cost of pipe fluctuates often and you will have to make adjustments in accordance with your present day prices on pipe. I have also found that this tabulation is a big help and time saver in making estimates on the big extensions that are made by our department in our regular expansion programs.

You know, Bill, I certainly have learned a lot from you since we started exchanging ideas, and it has dawned on me that little simple things that one does every day that seem so elementary, are often new ideas and important to other fellows; and, after all, Bill, living is made up of little simple things, but when they are put together you have got something.

ESTIMATE OF COST OF MAINS PER FOOT

(Labor at $0.38 per hour—Pit Cast Pipe at $60.00 per ton—DeLavaud per foot.)

	Galvanized			Cast Iron—Pit Cast Pipe								
Size	1 in.	1½ in.	2 in.	2 in.	4 in.	6 in.	8 in.	10 in.	12 in.	16 in.	18 in.	20 in.
Trench—												
Width	18 in.	18 in.	18 in.	20 in.	20 in.	20 in.	22 in.	24 in.	26 in.	30 in.	34 in.	36 in.
Depth	31 in.	32 in.	32 in.	40 in.	48 in.	52 in.	54 in.	56 in.	58 in.	66 in.	70 in.	73 in.
Cover	30 in.	30 in.	30 in.	36 in.	40 in.	41 in.	41 in.	41 in.	41 in.	44 in.	46 in.	46 in.
LABOR & MATERIALS												
Trench and fill, cu. yd.	$1.90	$1.90	$1.90	$1.90	$1.90	$1.90	$1.90	$1.95	$1.95	$2.00	$2.00	$2.00
Trench and fill, per ft.	0.27	0.28	0.28	0.39	0.47	0.51	0.58	0.66	0.76	1.02	1.22	1.35
Haul pipe	0.02	0.02	0.02	0.02	0 03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
Lay pipe	0.02	0.02	0.02	0.03	0.06	0 09	0.12	0.15	0.18	0.24	0.27	0.30
Pipe (f.o.b. siding)	0.10	0.17	0.22	0.28	0.63	0.97	1.40	1.87	2.38	3.75	4.53	5.22
Joint material	...	...	...	...	0.03	0.04	0.05	0 06	0.07	0.09	0.10	0.11
Sub-total	$0.41	$0.49	$0.54	$0.72	$1.22	$1.65	$2.20	$2.80	$3.46	$5.18	$6.21	$7.08
Overhead—15%	0.06	0.07	0.08	0.11	0.18	0.25	0.33	0.42	0.52	0.78	0.93	1.06
	1 in.	1½ in.	2 in.	2 in.	4 in.	6 in.	8 in.	10 in.	12 in.	16 in.	18 in.	20 in.
BASE COST	$0.47	$0 56	$0.62	$0.83	$1.40	$1.90	$2.53	$3.22	$3.98	$5.96	$7.14	$8.14
For DeLavaud Pipe—												
Pipe (per ft. f.o.b. siding)	...	...	...	...	0.56	0.82	1.17	1.57	2.02	3.09	3.72	4 34
BASE COST—(With labor and materials approximately the same as above)	...	...	...	...	$1.32	$1.73	$2.27	$2.86	$3.57	$5.20	$6.21	$7.13
ADD for Cement Lining	...	...	...	...	$0.03	$0.06	$0.10	$0.13	$0.17	$0.24	$0.27	$0.30
ADD for Cutting and Restoring Pavement												
2-in. Penetration	$0.20	$0.20	$0.20	0.22	0.22	0.22	0.23	0.25	0.27	0.31	0.34	0.36
8-in. Penetration	0.48	0.48	0.48	0.49	0.49	0.49	0 57	0.62	0.68	0.76	0.84	0.90
8-in. Concrete	0.70	0.70	0.70	0.75	0.75	0.75	0.80	0.87	0.95	1.05	1.15	1.20
Brick on Concrete Base	1.20	1.20	1.20	1.30	1.30	1.30	1.40	1.54	1.70	1.90	2.10	2.20

NOTE: All costs based on hand labor for trenching and backfilling, except compressed air used to cut pavement, drill hard rock and tamp backfill. BASE COSTS based on best conditions in non-congested sections.

ADD TO LABOR COSTS AS FOLLOWS:
10% for Intermediate Sections
20% for Congested Sections
110% for Shale
210% for Hard Rock and 6-in. Extra Depth of Trench for Clay Cushion.

For Fittings and Valves add 2% to 10% to BASE COSTS depending upon number and construction methods.

It has struck me, Bill, that it isn't the quantity of water you sell; it is how you sell it that makes a satisfied user and a booster of your customer. And, when you get them all boosting, it is just plain old psychology that you are getting somewhere.

Drop me a line again soon, Bill, and spill some of those ideas on me and I will write you again the first chance I get.

Your pal,

Tom.

▼

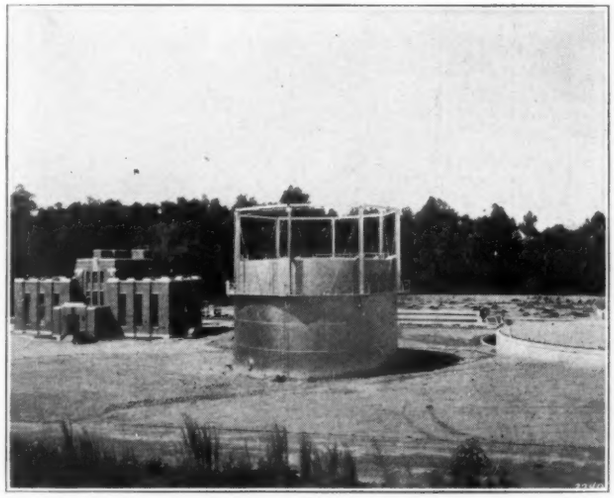
GREENSBORO'S NEWEST TREATMENT PLANT

Was Especially Designed to Handle Textile Wastes

One of the chief items on the program of the joint meeting of the North Carolina Section of A.W.W.A. and the N. C. Sewage Works Association, held recently in Greensboro, N. C., was the trip of inspection to the new Sewage Treatment Plant of Greensboro.

This plant, designed for treatment of domestic sewage and an important contribution of trade wastes from large cotton textile mills, is one of the most interesting plants in the country. Because of the especial attention given to design arrangements, making operation of the plan in a variety of ways possible, the Greensboro plant is outstandingly unique. Significant of a trend is the policy of the city authorities to provide treatment of wastes from an industry so important to the community as the textile mills of Greensboro.

The picture of the plant shows the Main Building on the left. In the foreground is the Chicago gas holder of 30,000 cu. ft. capacity, which serves as the fuel



"reservoir" for twin power units consisting of Worthington 160 H.P. gas engines direct connected to 2,400 Volt-100 K.W. Westinghouse generators. These units produce power for lighting the plant and driving 56 motors of various sizes. In the rear are the aeration tanks on the right the digesters equipped with P.F.T. Floating Covers.

This Northside plant, now receiving 3.2 m.g.d. average flow, constitutes Greensboro's second plant, the Southside plant having been completed in 1930.

Wm. C. Olsen of Raleigh, N. C.; served as consulting engineer on the project; C. W. Smedberg is Director of Public Works; W. M. Lybrook is Supt. of Water and Sewage; E. H. Moss, formerly in charge of water and sewage treatment at High Point, is Plant Superintendent.

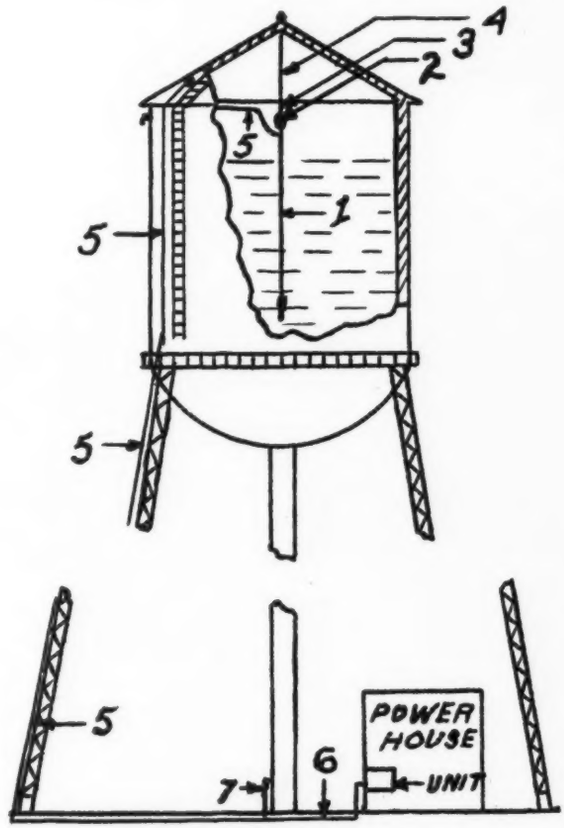
A NEW METHOD OF TANK PROTECTION

Experiences With an Electrical Method of Rust Prevention

By O. B. HESS
Supt. Water Works,
St. Clairsville, O.

Supt. Hess

THE cleaning and subsequent prevention of rust in water tanks by electricity is a comparatively new subject. It works on the principle of an electric current passing from an electrode in the center of the tank through the water to the tank itself. (See cut.) This is made possible by the use of an electrical device called a rectifier, a small device which is built according to the size of the tank. In our case at St. Clairsville it is approximately eight inches wide, nine inches high, and twelve inches long, to service a tank of 200,000 gallon capacity. This rectifier is installed as near the tank as possible and is attached to a 110 volt AC light circuit. It changes the current from AC to the DC current required for the process.

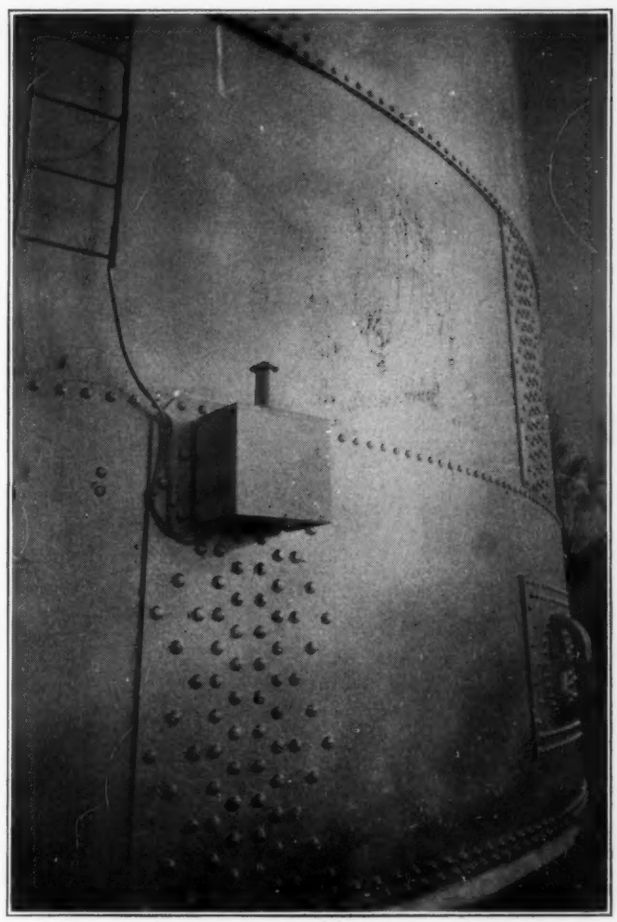


Tank Equipped for Electric Protection

1. *Solid Stainless Steel Electrode*
2. *Insulator—1,000-lb. Test*
3. *Wire Cable*
4. *Safety Cable*
5. *Service Cable Wire*
6. *Double Trenchlay Wire*
7. *Ground—Single Trenchlay Wire*

How the Scheme Works

The tank is equipped with a polished stainless steel shaft called an electrode. (See cut.) In our case the rod is one and one-fourth inches in diameter and fifteen feet long, suspended from the center of the top of the tank and insulated from the tank itself. This is to prevent the tank from grounding the current. The electrode is wire connected at the top direct to the rectifier. The current passes through this electrode and flows through the water to make contact with the tank. The tank is grounded at the bottom of the riser which gives a complete circuit from top to bottom.



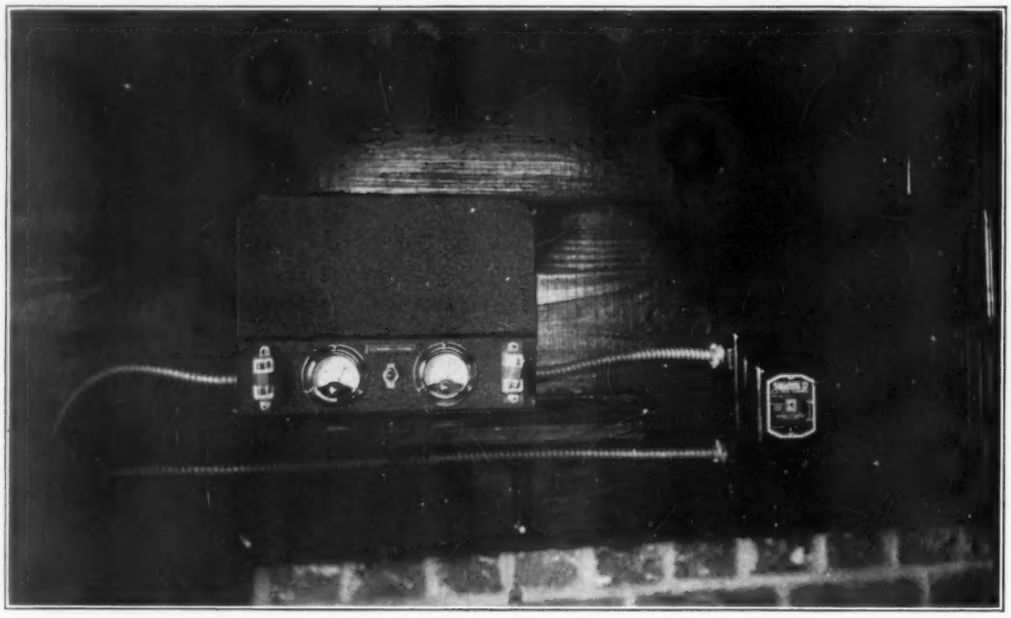
Rectifier Installed on a Water Tower
(Not at St. Clairsville, but is used to show another scheme and the small size of the unit.)

Our Experience

The current coming in contact with the inside of the tank seems to loosen and remove all corrosion and prevents any further rusting. It leaves a gray coat, or films, which covers the metal entirely. Upon examination of the practicability of this method of rust prevention the film was rubbed off with the fingers and the tank was found to be as clean and bright as when it was installed. Since the tank has been in service nine years, without anything having been done toward rust prevention, the result was very impressive.

The cost of the equipment installed by the manufacturers is based on the size of the tank. In our case, on a 200,000 gallon tank it was $325.00. Our operating cost has been approximately 40 cents a month, at 2 cents a KW. rate.

This electric device was built and installed by the Electro Rust Proofing Company of Dayton, O., on a demonstration basis. The results warranted the city purchasing the equipment.



The Rectifier

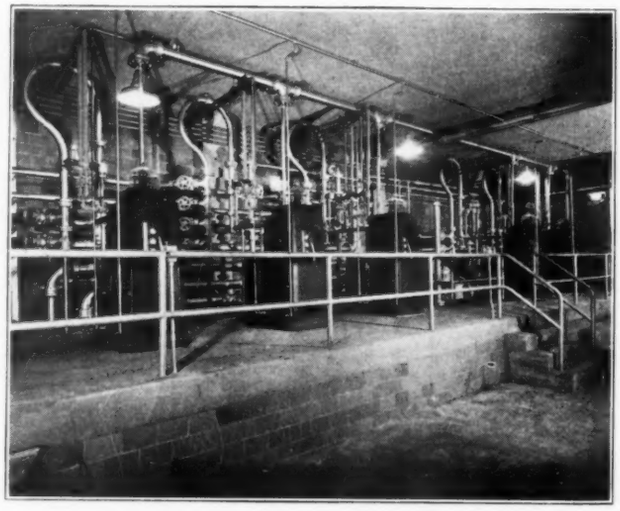
WORLD'S LARGEST CHLORINATING PLANT

Has Chlorinators of 6,000 Lb./Day Capacities

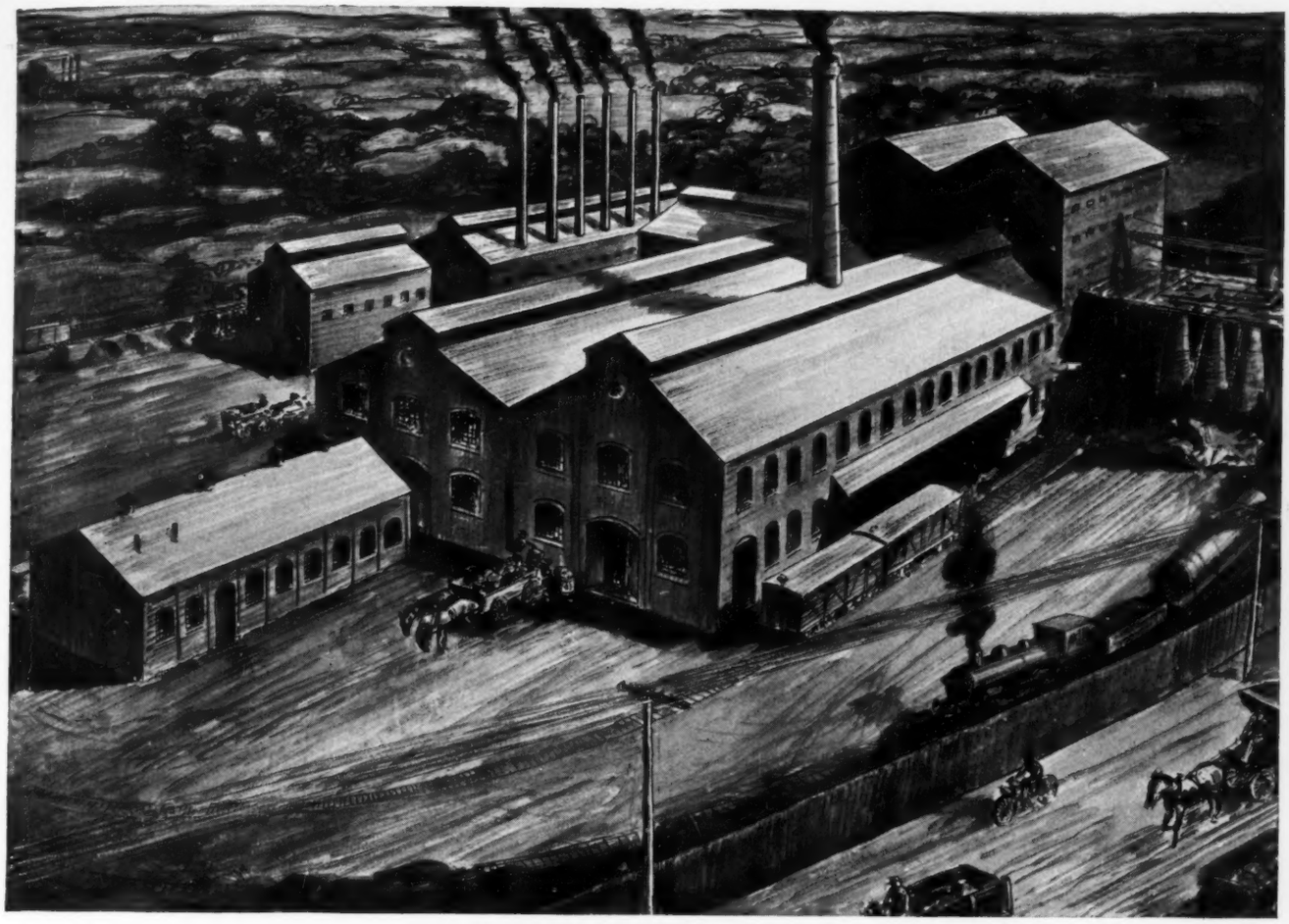
What is adjudged to be the world's No. 1 Chlorination Station, in respect to size, has recently been completed as a part of the new St. Paul-Minneapolis Sewage Treatment Works. This plant is capable of feeding two multi unit tank cars of chlorine per 24 hours—i.e., 30,000 lbs./day.

To avoid the necessity of installing an excessive number of chlorinators Wallace and Tiernan Co., by special design with super-injectors, raised the capacity of their one ton Master Chlorinators to machines of 6,000 lbs./day capacity each, five such machines being installed instead of 15 machines of one ton capacity each. Substituted for water, strained sewage effluent from the clarifiers is employed to operate the delivery injectors—the only city water used being that going to the machine trays and resulting in a marked saving.

Especially interesting is the design and layout of the chlorine-solution headers and distribution piping to several points of chlorine application in the plant. Much of the chlorine capacity is installed for the production of chlorinated-copperas, employed as the sewage coagulant. In addition, odor control and partial or complete disinfection is provided for. Chlorine is purchased in single unit tank cars from which the liquid is forced to the evaporators by air pressure, applied to the top of the tank cars, whenever chlorine gas pressure is not ample to maintain the desired rate of liquid discharge to the heated evaporators. The plant is also equipped with lime-feeders for making use of the effective lime-chlorine process, wherein chloramines are produced from the ammonia naturally present in the sewage.



Chlorinating Plant at New St. Paul-Minneapolis Sewage Treatment Works.



VIEW OF ORIGINAL PLANT IN 1900

Through The Centuries With Alkalies

HERE in 1900 began production of COLUMBIA Soda Ash. Quickly the plant grew. In 1901 COLUMBIA Caustic Soda was first produced. Important by-products further contributed to rapid growth. In 1936 came the first production of COLUMBIA Liquid Chlorine. The same year saw the development of COLUMBIA Sodium Bicarbonate. Other Alkali and Chemical Products are supplementing this line as fast as man's inventive genius discovers better ways to fill man's ever-increasing needs.

OUR PART is humble; our products unromantic. But in the making and processing of many of the oldest, most useful, most necessary commodities on earth they play a vital part. Upon the quality of our output depends the quality of innumerable productions. Glass is clearer; paper is whiter; textile fibres are finer; even the bread we eat and the water we drink are purer, because of the way we do our part. So, accepting this responsibility, we serve the needs of industry with faithfulness and zeal, vigilantly maintaining exacting standards which permit no compromise with quality—and never will.

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CAUSTIC SODA
SODIUM BICARBONATE
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"THE REMEMBRANCE OF QUALITY PERSISTS LONG AFTER THE PRICE IS FORGOTTEN"

This statement is particularly significant in the water purification field as it can truly be said that the consumers consciousness of their water supply is only aroused by the poor quality of its tap water.

The difference between a palatable and non-palatable drinking water is the cost of a very few cents per year to each consumer.

AQUA NUCHAR does an effective "job" of removing taste and odors from water at such a low per capita cost that today little reason exists for tastes and odors breaking through.

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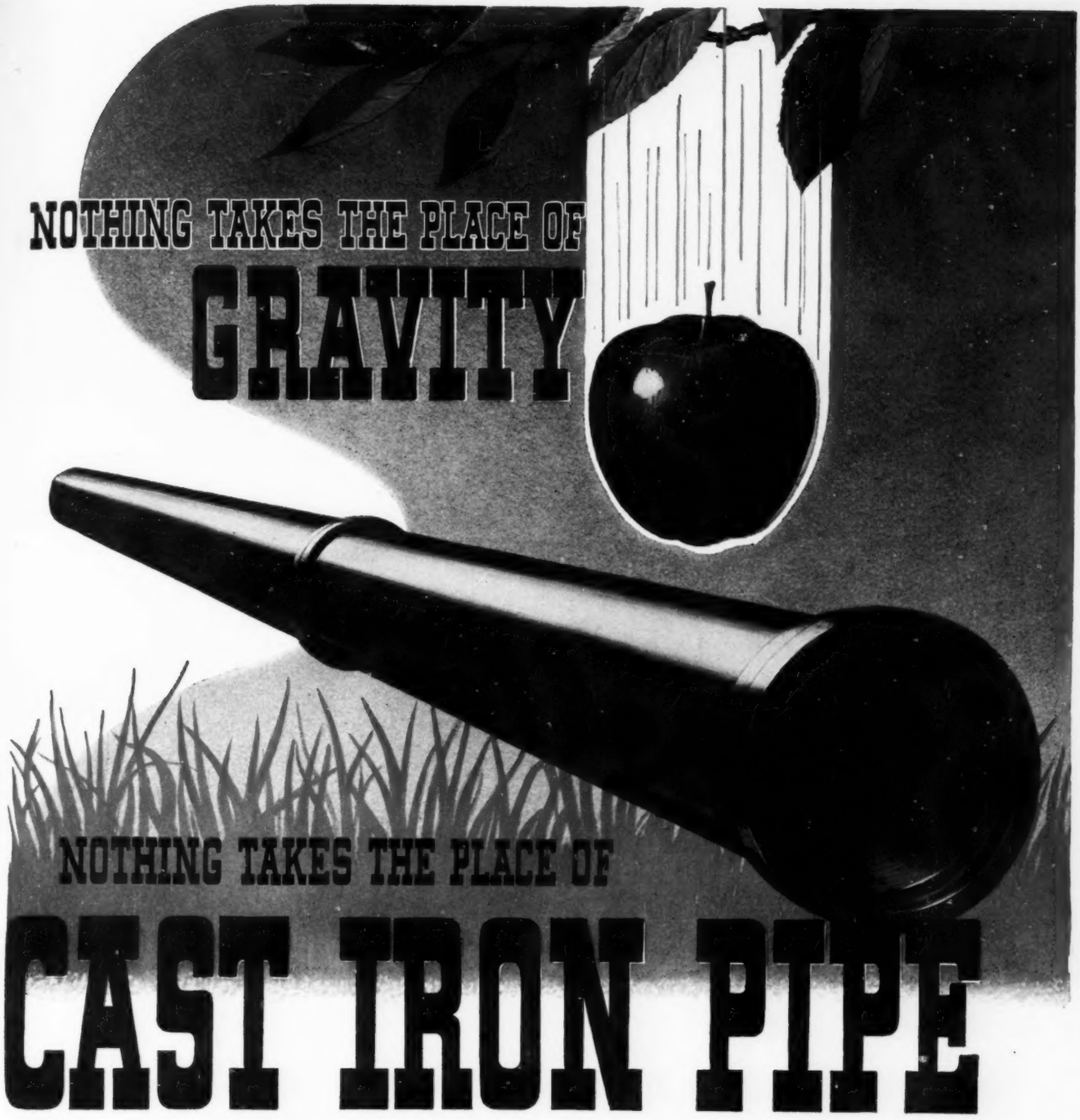
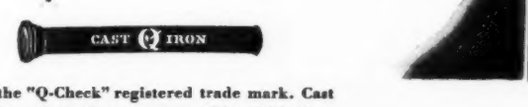


CAST IRON PIPE

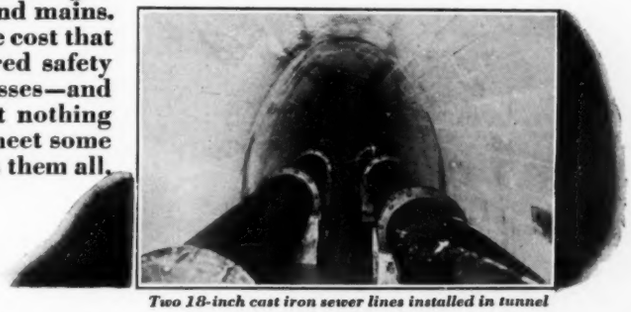
THE tree from which Newton's apple fell was cut down in 1820. A cast iron underground main, laid in Newton's boyhood (1664) is still rendering satisfactory service. No one will argue the unique necessity of the law of gravity. Few will argue the indispensability of cast iron pipe for underground mains.

If you want proved long life and low maintenance cost that result from effective resistance to corrosion—assured safety margins for impact, beam load and crushing stresses—and permanently tight joints—then you will agree that nothing takes the place of cast iron pipe. Some materials meet some of these requirements but only cast iron pipe meets them all.

THE STANDARD MATERIAL FOR UNDERGROUND MAINS



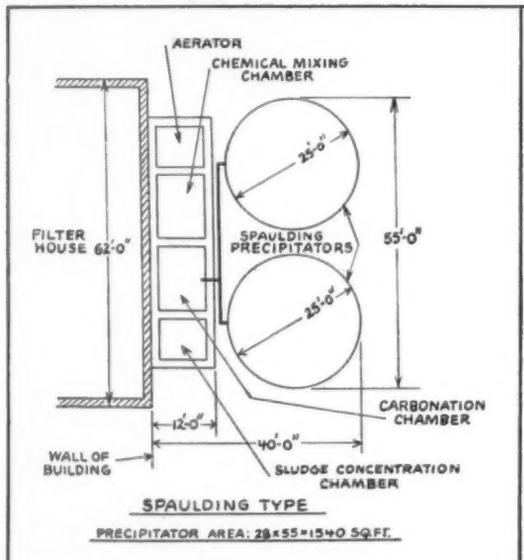
Look for the "Q-Check" registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.



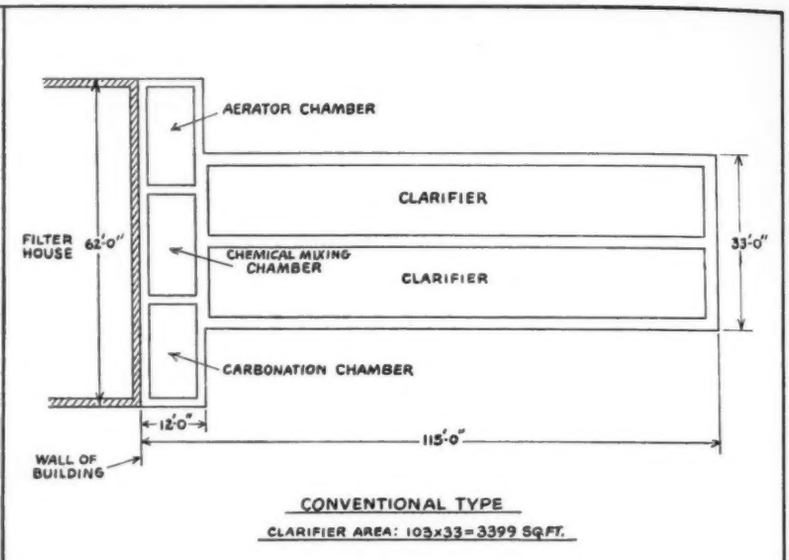
Two 18-inch cast iron sewer lines installed in tunnel under the Chicago River.

THE CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1015 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

Permutit's Spaulding Precipitator *Takes the Blue Ribbon* for Cold Lime Treatment



TYPICAL SPAULDING PRECIPITATOR LAYOUT



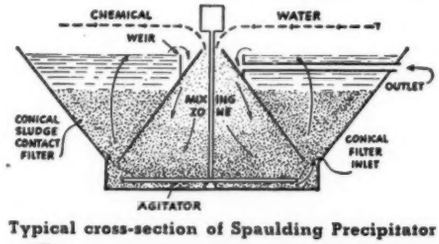
CONVENTIONAL COLD LIME LAYOUT NEEDS OVER TWICE THE SPACE!

Permutit's revolutionary new Spaulding Precipitator takes less than half the space required by conventional type settling basins. It consists of two compartments (see diagram below)—(a) Mixing Zone, and (b) Conical Upflow Sludge Contact Filter. Chemical and raw water enter mixing zone, where agitators mix newly forming precipitates with retained older sludge of controlled density. *No settling takes place* . . . an exclusive feature!

In ordinary settling basins, sludge settles from water before full reaction occurs. To correct this, practice has been to return deposited sludge. But this may give treated water bad taste or odor. In the Spaulding Precipitator, however, *sludge is kept suspended*, as explained at left. This exclusive feature speeds up precipitation, keeps sludge fresh. Softening is accomplished without putrefaction—so completely that recarbonation is often unnecessary.

Continuous recirculation of preformed sludge cuts down the amount of chemicals necessary. Other features of Permutit's new Spaulding Precipitator: Conical shape of filter compartment makes sludge-filter uniformly dense throughout. Thus the efficiency of the filter is maintained, and effluent is remarkably clear. Correct density of sludge assured by an automatic blow-off arrangement.

These results are obtained every day—in practical operation, in both large and small plants. Complete description of Permutit's new Spaulding Precipitator and how it may also be used for coagulation of turbid or colored waters is contained in a free, authoritative booklet. Write today to The Permutit Company, Dept. G1, 330 West 42nd Street, New York.



Typical cross-section of Spaulding Precipitator

PERMUTIT OPERATING TABLES AND CABINETS

Eliminate need for a full-time attendant at municipal water plants using pressure filters or zeolite softeners. Four different types of control available: Fully Automatic, Semi-Automatic, Manual Electric, and Manual. Write today for free booklet.

ANNUAL CONVENTION OF C.S.W.A.

Meeting Place.
(Even Californians Marvelled.)

At Santa Barbara, California

Reported by A. M. RAWN*

Associate Editor.

THE eleventh annual fall convention of the California Sewage Works Association was held, conjointly, with the League of California Municipalities, in Santa Barbara, where the meetings were held in the Supervisors' Room of Santa Barbara's remarkable County Court House. As a public building this Court House is perhaps second to none in the country in beauty and it certainly is without an equal in commemorating the early history of the section which it represents. Bordering two sides of a municipal park and garden filled with rare plants and shrubs, growing side by side with those indigenous to the area, stands this beautiful white stone and stucco building reminiscent of old Spain and Mexico. Padre-tile lines the long corridors, winding outside stairways lead from floor to floor; even the appointments carry the flavor of the early settlers' habits and characteristics; and the very center and hub of the old building—and without doubt the most beautiful room therein—is that of the Board of Supervisors. As accustomed as they are to the influence of Spanish architecture in California, members of the Association were considerably impressed with the beauty of the meeting place, and the hospitality of the governing board of the county.

The convention, well attended by visitors from neighbor States as well as Californians, was interesting not only because of the exceptional merit of the meeting place, but also because of the technical value and interest of the papers presented. The technical papers held the close interest of all in attendance and the convention was pronounced one of the most valuable during the eleven years of existence of this Association.

Officers Elected

On Tuesday morning at a short business meeting, Alexander B. Bell, western representative of the Wallace and Tiernan Corporation, was elected the Association's president for 1939. H. G. Smith, sanitary engineer for the City of Los Angeles, was elected first and H. F. Gray, consulting engineer of Berkeley, second vice-president. C. F. Tennant, superintendent of the Joint Disposal Works of the Los Angeles County Sanitation Districts, was elected a director for a five-year term. R. R. Ribal was returned as secretary-treasurer, and Mr. Carl Beyer of San Francisco, was appointed Federation Board of Control member.

Inspection Trip

The convention closed with motor caravan trip to the Ojai subsidence, trickling and sand filter plant; thence to the new steel pipe ocean outfall of Ventura; and thereafter, to the Camarillo State Hospital plant, which employs bio-filtration.

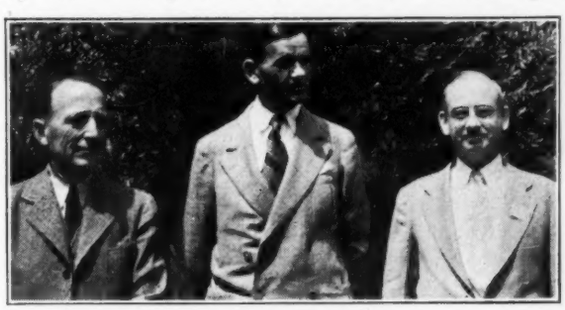
Ontario Wins Merit Award

At the Tuesday dinner meeting the Award of Merit Plaque and $25.00 cash prize was presented to Ontario and accepted for the city by H. M. Ely, Plant Superintendent. This award is made annually to that city which has shown outstanding merit in plant operation, management or improvements.

Papers and Discussion

"Pumps in Sewage Works Practice," by W. M. BEADLE, Engineer, Byron Jackson Pump Company, Los Angeles.

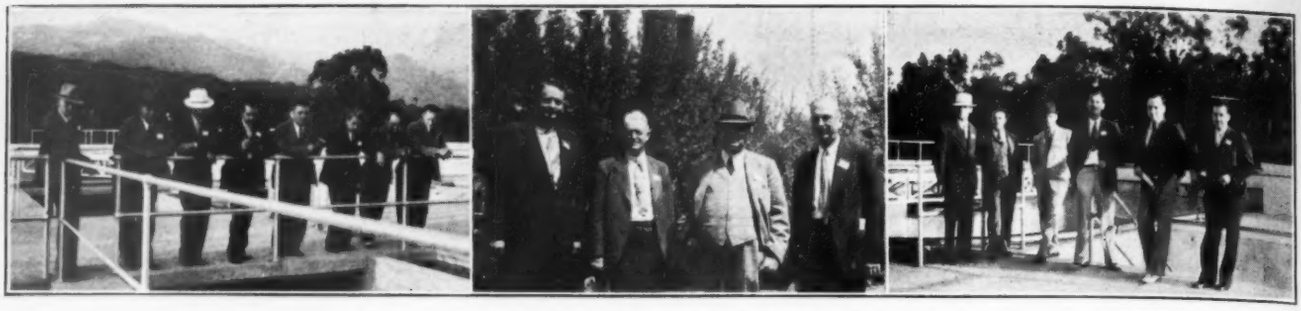
Mr. Beadle stated that a few years ago it was felt that a dependable non-clogging sewage pump could not have reasonably high hydraulic efficiency. Sewage pumps of today belie this prediction, however, and such pumps



Presidents and Host
President (1939)—*Alexander Bell, San Francisco*
Host —*Adolf Postel, Santa Barbara*
President (1938)—*Ray F. Goudey, Los Angeles*

showing efficiencies above 80 per cent are now being produced. The speaker cited examples of some important refinements in the mechanical construction of both vertical and horizontal pumps. At the Terminal Way sewage plant City of Los Angeles now had two 10-inch vertical, single stage, centrifugal units, with 2-port, non-clogging, bronze impellers, with capacities of 4,275 gal-

*Asst. Chief, Los Angeles County Sanitation Districts.



On the Plant Inspection Trip

In this group—A. Schapp, C. C. Kennedy, Richard Pomeroy, W. J. O'Connell, G. T. Luippold. (2) Dean Sam B. Morris, Stanford University; W. T. Knowlton, Los Angeles Bureau of Sewerage; C. C. Kennedy, Cons. Engr., San Francisco; W. K. Palmer, Engr., Los Angeles County Sanitation Distr. (3) From the left—Dr. Richard Pomeroy, A. P. Banta, A. C. Beyer, R. F. Stevenson, B. J. McMorrow (Pres. Arizona Sewage Works Ass'n), W. J. O'Connell.

lons per minute at 60 ft. total dynamic head. Both pumps rotate in the same direction and spare parts are interchangeable. Pump and motor are connected by means of stainless steel shaft enclosed in a telescopic column. Dayton couplings, with tie-rods, obviate dangerous stresses in the pump casing.

The 8-inch horizontal pumps in the Kapalulu Station, Honolulu, were cited as of particular interest in the design of the large shaft supporting the one-piece, two-port, overhung, single suction, bronze impeller. Split babbitt-lined sleeve bearings carried the radial load, and ball bearings the axial load. Pump housings and bearings are split on the horizontal plane. Suction and discharge piping connections are entirely in the bottom half so as not to be disturbed when the rotating element is removed. Each pump delivers 2,100 g.p.m. at 75 ft. head, with an efficiency barely under 80 per cent. The speaker then described a new 4-port, double suction pump of non-clogging design. Such design permitted the use of suitable bearings on both sides of the runner; and, the special shaft sleeves employed do not rotate with the shaft, thus guarding against winding on of strings, rags, etc.

"Items to Be Considered in Selecting a Sewage Pump," by JOSEPH CORRAO, Supt. of Pumping Plants, San Francisco.

In suggesting the factors to be considered in sewage pump selection, Mr. Corrao pointed out that clogging had been one of the most troublesome factors and that therefore any horizontal pump chosen should be equipped with horizontally split case. Unfortunately in vertical pumps the split case was only furnished in very large sizes but the case of a vertical pump may be equipped with access holes on the discharging side of the volute to promote ease in cleaning. In addition, the speaker advised that all valves on suction or discharge sides should also be equipped with hand holes.

Mr. Corrao stated that San Francisco's best service had come from the use of 2-port enclosed impeller pumps, which statement is in line with experience elsewhere in California. He directed attention to the fact that a right angle bend at the discharge outlet of the pump will cause unequal thrust and consequently unequal wear on the impeller, and is to be avoided if possible. He particularly warned against flimsy bearings and supports on long vertical shafts. Continuing with a comparison of ball and sleeve bearings, he stated that the latter are not often used in modern pump construction, that while they have a tendency to retard vibration, friction is higher in their use and consequently the pump is rendered more costly of operation. He then enumerated some of the deficiencies inherent in oil seal rings, stating that they should be far easier to remove and replace than at present. Shaft sleeves, he said, should be of extremely hard metal to resist scoring. In concluding, Mr. Corrao warned all and sundry not to hesitate to specify a special pump for special conditions; that many times the standard pump could not be economically or satisfactorily adapted to a special service.

"Packings for Pump Bearings," by BARD LIVINGSTONE, Supt. Water Department, San Bernardino, Cal.

Mr. Livingstone said that during the past ten years plastic packings have come into general use; that they are made for a wide variety of conditions in pumping and that the use to which they are to be placed should be specified at the time of purchase. He spoke of a new type of packing called "Meta-Film" which, he stated, coats over the sleeve and gives it a lustrous polish, filling small pits and scores. He stated that all packing must be lubricated with graphite from time to time and that connections for lubrication should always be provided. As to the setting of gland bolts, Mr. Livingstone said that after the pump shaft has rotated about fifteen minutes, the nuts on the gland bolts should be turned up until they are finger-tight; that this will usually suffice if the packing has been carefully placed.

When the sleeve is slightly out of round or is whipping, or if it is scored in any manner and the difficulty cannot be rectified with ease, a soft packing of ordinary cotton type is as good as any. Furthermore, that under these circumstances no packing should be expected to give extended service. The paper included a detailed description of the elements which enter into good packing construction as well as its method of placement in the bearing. Concluding, Mr. Livingstone urged operators to consult with the expert representatives of the firms which furnish packing materials before buying.

"Santa Barbara Harbor Problems," by ADOLPH POSTEL, Chairman, Board of Harbor Commissioners.

Commissioner Postel explained how a breakwater built by the city had caused sand moving shore currents to be set up which had robbed Santa Barbara of a satisfactory bathing beach. The breakwater had been built in the face of repeated warnings of consequences by the U. S. Engineers Corps. The proper move to correct the situation was still an open question.

Mr. Postel stated, further, that the treatment plant and ocean outfall of the sewerage system of Santa Barbara were in deplorable condition and needed immediate repairs or replacements.

"Remodeling of Old Plants to Increase Efficiency," by JUD HARMON, Asst. Sanitary Engr., California Public Health Department, Berkeley.

In California, the speaker said, there are 67 septic tanks, 80 Imhoff tanks and 42 trickling filters that need to be remodeled or repaired; and while many times it is a mistake to attempt to make over an old plant rather than to construct a new plant, there are times when the old works may be incorporated in the new to advantage. The speaker recognized that each design called for an independent solution but stated that under certain circumstances septic and inadequate Imhoff tanks might be converted to separate sludge digestion chambers and with the addition of primary clarifiers, with or without chemical precipitation and continuous sludge removal, a rehabilitation of the plant could be effected with benefit. As to trickling filters, the speaker suggested that new nozzles, rotating arms and increased depth might be used to materially increase efficiencies. Interesting among his remarks was one to the effect that twenty-five years ago Imhoff tanks in California were designed with sludge digestion compartments providing only 0.75 cu. ft. per capita digestion space; that at the present time 3 cu. ft. per capita is not uncommon in design and it is therefore not surprising that many tanks are outmoded.

In a written discussion C. C. Kennedy, San Francisco, consulting engineer, stated that it was definitely true that it is much easier to utilize a treatment plant site that has been used than to overcome local objection to the establishment of a plant on a new site, adding that this argument applied with force in contemplated construction of new works. He pointed out that recent developments in mechanical equipment have greatly multiplied the aids which may be employed and stated that a good and intelligent operator who is a competent observer of conditions may be of great assistance in remedying inadequacies and in suggesting changes which will increase efficiency. Mr. Kennedy, who probably has had as much experience as anyone in the West in meeting resistance to spending for sewerage betterments, which is evidenced by so many small municipal governing boards, said: "No loading in excess of established standards of performance is excusable unless the available funds do not make possible the provision of adequate sized units."

[In this statement the speaker sums up a situation which continually appears in sewerage practice—namely, if you can't get all that is required, get the best you can.—A. M. R.]

Mr. Kennedy agreed that in reconditioning an old plant, helpful pretreatment of sewage may be accomplished by chlorination, grease removal, additional screenings removal, grit removal and flocculation and clarification, either with or without the aid of chemicals. Inadequate oxidation units may be made to function more satisfactorily by decreasing the organic load or distributing it more uniformly over the day. The load may be reduced by the removal of greater portions of organic matter through more adequate pretreatment or by dilution of the sewage ahead of the oxidizing unit. Inadequate sludge digestion tanks could be supplemented by secondary tanks or lagoons for advantageous stage digestion, or the sludge might be thickened prior to entering the digestion unit. At times the treatment process may be improved by careful treatment of returned supernatant liquor from digestion tanks. Mr. Kennedy said that no plant need be considered wholly obsolete and that those engaged in sewage practice are now "undoubtedly entering an era when the value of technical advice can be more accurately measured by the cost of plant operation than by the cost of construction."

"Conditioning and Sale of Sludge for Fertilizer," by WILLIAM A. ALLEN, Supt. Sewage Disposal Plant, Pasadena.

"Conditioning sludge for sale as fertilizer at Pasadena developed as a necessity in sludge disposal," said Mr. Allen. Prior to the installation of sludge drying equipment at the plant in 1927, disposal had consisted of flooding wet sludge on city-owned orange groves; by filtration and burial of the sludge cake in trenches, or by impounding in a gravelly wash adjacent to the plant site. None of these methods were successful, all gave rise to odors and much bitterness and complaint from nearby home owners, therefore in January, 1927, following installation of mechanical drying equipment, sludge dehydration was commenced. It was found at the start that a filter cake with as much as 85 to 87 per cent moisture resulted in poor drying. Experience then, and since that time, indicates that cake moisture should not exceed 85 per cent in any event. Below this upper limit of moisture content the amount of water to be removed is determined on the basis of balance between coagulant and fuel required which results in minimum overall production costs. Early in the operations sulphate of alumina was used as a coagulant. Without the addition of an equal amount of diatomaceous earth the filter cake moisture content was 83 to 85 per cent. Later, with the filter aid addition, this was reduced to 80 per cent. Filter aid was continued with sulphate of alumina until June, 1930, when ferric chloride proved the superior coagulant, and was adopted. In 1933 the use of the filter aid was abandoned and ferric chloride alone has been used since that time.

Mr. Allen stated that, based on experience, the time between dosing the sludge with the coagulant and delivery to the filters should be as short as possible; that reaerated sludge had required less coagulant than sludge taken directly from the final settling tanks. He said that when the suspended solids in the sludge are between 5,000 to 7,000 parts per million, about 200 pounds of coagulant will be required per ton of dry solids; that if the suspended solids are increased to between 9,000 and 10,000 p.p.m., between 7 and 8 per cent, or approxi-

Wm. J. O'Connell, Engr., W. & T. Co., San Francisco, and R. D. Woodward, Chief Operator, Laguna Beach. (2) Homer Buckley, Ass't City Atty., Oakland. (3) H. F. Gray, Cons. Engr., Berkeley, and A. M. Rawn, Asso. Editor "Water Works and Sewerage," Los Angeles. (4) A. K. Warren, Chief Engr. and Genl. Mgr. Los Angeles County Sanitation Districts. (5) H. M. Ely, Supt. Treatment Plant, and the late Austin Burt, City Service Mgr., Ontario. (To Burt and Ely went the 1938 Award of Merit, Mr. Burt having passed away shortly after convention.)

(1) To Santa Barbara County's new Court House to meet; (2) to Santa Barbara's famed patio of El Paseo to eat; (3) Then back to business in the Supervisor's Sanctum; (4) Relief map of Santa Barbara, nestling against a high mountain range, facing south, drinking sunshine—but, somewhat lacking in sewage disposal facilities.

mately 150 lbs. of coagulant will be required per ton. Prior to sale as fertilizer the sludge is dried in direct-indirect rotary heaters to about 5 per cent moisture. It is then pulverized, screened and sacked in burlap bags containing 100 lbs. net weight each. Sludge is marketed by direct sale through a limited number of distributers. The sale of sludge is supervised by the Purchasing Agent of the City of Pasadena who fixes the price per ton f.o.b. the plant warehouse. No deviation is permitted. The material is sold on a guaranteed analysis basis of 6 per cent nitrogen, 3 per cent phosphoric acid, and 0.3 per cent potash. Between 1932 and 1937 the sale of sludge from the plant has reduced the cost for sludge disposal from $14.12 per million gallons of sewage treated to a profit of 2c per million gallons. In 1938, because of adverse crop conditions and lack of sludge sales, the cost per million gallons for sludge disposal has increased to $4.51 per million gallons of sewage treated. It was interesting to note from Mr. Allen's report that during the last full year when the sludge cake was buried, the cost for sludge disposal was in excess of $54,000. In 1936-37 a profit of $52.13 resulted. So far in the adverse year of 1938 disposal has cost a little over $14,000.

"Control of Chlorination," by A. CARL BEYER, District Manager, Wallace & Tiernan Corp., San Francisco.

Opening this topic, Mr. Beyer stated: "The treatment of the subject is an endeavor to present a fresh viewpoint which will serve as a basis for a re-appraisal of sewage chlorination." Discussing the basic reasons for sewage chlorination, Mr. Beyer stated that it might be used with advantage in the influent; in grease removal units, flocculators, primary clarifiers, trickling filters, return activated sludge lines, final effluent, sludge thickeners, and supernatant liquor return lines. He then stated that chlorine or its derivatives may be utilized for (1) sterilization or oxidation, (2) reaction with sulphides, (3) electrolyzation of colloids or coagulation of suspended solids. Mr. Beyer then said that, considering the fundamental uses of chlorine and its derivative salts, it was indicated that a plant could be equipped with a type of apparatus which would permit the application of chlorine or its ferrous or ferric derivative at intervals throughout the process as required; that such apparatus may be economically constructed and is being included in the design of a number of projected plants in California. In closing his discussion he revealed that a new type of automatic sewage chlorinator is being developed. This will vary the dosage geometrically with the flow, in order to compensate for simultaneous increased flow and increased strength. Mr. Beyer concluded with the statement that chlorine and its iron salts produced from one installation is a many-edged tool; that one may be sure sewage flows will continue to come weak, medium and strong (particularly strong), at the most embarrassing moments, at which time chlorine application serves one of its most useful purposes.

"Patents in the Design of Sewage Treatment Works," by A. SCHAPP, Patent Attorney, San Francisco.

Mr. Schapp described in detail the method of securing a patent and outlined the limitations in the authority granted for its use. For instance, an invention which merely extends the possibility of an earlier basic invention does not grant the inventor the right to use the basic invention along with his own. In fact, a patent does not grant the inventor the right to do anything. It only protects his new conception from infringement by others. The speaker described a number of patents in the sanitary field which have involved municipalities and others in litigation during the past years. He cited, particularly, the case of Activated Sludge, Inc. as an outstanding example of what patent infringement may lead to in the way of eventual costs. He stated that the rights to use the equipment marketed were guaranteed, as a rule, by all responsible manufacturers of sewage works equipment.

"Legal Aspects of Sewer Rental Laws," by HOMER BUCKLEY, Asst. City Engineer, Oakland.

Discussing the laws relating to sewer revenue possibilities in California, Mr. Buckley stated that cities of the fifth and sixth class derive their authority for government solely from the State constitution. In the Constitution there is no authority for invoking sewer revenue measures as a means of defraying the cost of construction, or expenses of operation and maintenance of their systems; that all other classes of California cities are incorporated under charter provisions and that under such circumstances, in his opinion, the municipality had the right to proceed under sewer revenue measures for construction or extension of systems or for the operation and maintenance thereof. It did not appear from the speaker's statements that Sanitary Districts were endowed with this authority. The speaker cited the case of Madera, California, as one of the fifth or sixth class cities which attempted the use of a sewer rental measure. When legal action was taken by one of the citizens, the Courts ruled that the city was without authority to collect fees for sewerage service and that monies for such purposes must be collected by general taxation. The speaker's remarks provoked some argument, particularly from A. K. Warren, Chief Engineer and General Manager of the Los Angeles County Sanitation Districts, who, commenting upon Mr. Buckley's statement that Sanitary and Sanitation Districts were cumbersome, cited the large number of such districts successfully operating in California and elsewhere, and the impressive population being served thereby. Mr. Warren also directed attention to the fact that the Madera case was a special one, wherein sewer revenues were being collected and used to *extend* a sewer system already constructed under other District Improvement Acts; that the ruling of the Courts in this case need not necessarily apply in the case of a new sewerage system.

"Disposal of Non-Polluted Waters from Cooling Systems," by JEAN L. VINCENZ, Commissioner of Public Works, Fresno.

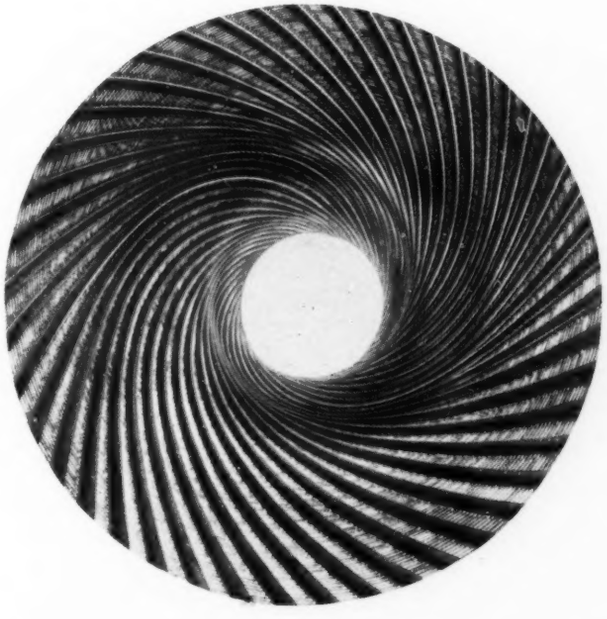
Mr. Vincenz stated, as his opinion, that while air conditioning is now almost entirely confined to the warmer desert cities in California, the time would not be far distant when air conditioning will be invoked in all of the larger California cities. Because of this, many cities not now perplexed with the disposal of the cooling waters from temperature control systems, will have to face the problem in the near future and should prepare themselves for it. Specifically the speaker stated that for an ordinary 2-ton home air conditioning unit the rate of water usage without recirculation is 180 gallons per hour and that, in general, a unit may be expected to utilize 90 gallons per hour of water per ton of capacity. The staggering amount of water which may be consumed for this purpose is clearly evident from these figures and Mr. Vincenz pointed out that encouragement should be given to development of recirculation of cooling systems which will permit the reuse of water; that by this means water consumption may be reduced to 5 per cent of the amounts hereinbefore stated. Even so a single home unit may be expected to use more than 200 gallons per day of water in addition to all other present requirements. The speaker then described a number of units successfully employed in and about Fresno; some of high efficiency and low water consumption and some the exact reverse. In fact, one described was the simple but effective means of running the cold shower bath all day and leaving the bathroom door open! In his concluding remarks Mr. Vincenz stated that air conditioning is unquestionably here to stay and that the water and sewerage engineer may just as well determine to face that fact.

(*Adjournment*)

▼

BIG BERTHA?

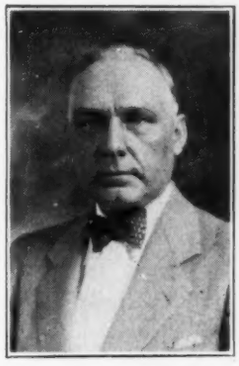
This interesting picture might be a view through the barrel of a "Big Bertha," but it's not.



It came to us from Edward E. Johnson, Inc., of St. Paul, Minn., manufacturers of well screens. At first it appeared to be a view through a rifle barrel. On second examination it appeared to be a new spiral reinforced design of a well screen. However, it proved to be neither. It is a view through a Johnson well screen of normal design after it had been subjected to a severe twisting, to test the toughness of these screens and the tenacity of the welding which attaches the reinforcing rods to the screen membrane. From the regularity of the rod spacing after the twist, apparently this screen proved hat it could "take it." Although we doubt that many well screens will be called upon to stand the punishment given this one, the picture is not without interest.

▼

CORNELIUS A. BLAUVELT
1867 - 1938



FEW people knew him well, but intimacy was not necessary to a recognition of Cornelius Blauvelt's fundamental integrity. One could not be with him long in a business call, a personal or a group conversation, or a mere casual meeting without realizing that here were strength and confidence based on honest faith in what he did and said and stood for. You might disagree with him, but you could not doubt his sincerity.

This honesty was one (and perhaps the most important) of five factors which made him a successful salesman. The other four were a thorough and systematic knowledge of his subject, continuous hard work regardless of encouragement or the reverse, a genuine interest in the welfare of his customers, and an unfailing cheerfulness. He was never showy in presenting a case, but when he finished, his hearers knew definitely what he had to offer and why he considered it worth its price. If more information was asked, he got it if possible and presented it, not as a favor for which return favors might be expected, but as a simple and reasonable part of business. The result of this simple and direct work was a sales record which younger men might, and did, envy.

As could be expected, Blauvelt's life in business was a natural parallel to his private life. His friendship was never effusive, but we learned in time that it was deep. To those he found in trouble or perplexity he spoke common sense, at once sound and sympathetic, but only when it was plain that such help was welcome. Intrusion and officiousness he avoided as scrupulously as he did falsehood. Still further, his kindliness stood the material test; he gave time and money according to his means, but in secret and unobtrusively as he gave advice.

Humor he had, too—quiet, gentle and used sparingly——in keeping with his character.

Cornelius Blauvelt joined the sales organization of Gillette Publishing Co. at the age of 59 without previous experience in such work. Mistakes and trying situations were inevitable, but his energy and strong character carried him to an established and unquestioned success. Though intimate with few, he had a friendly acquaintance literally with hundreds of manufacturers and advertisers in the water works and highway fields. He died November seventh after an illness of several months, although he had been at work within less than four weeks of his passing.

18TH OHIO WATER CONFERENCE

Hears About Precipitators, Chlorinated Copperas, "Calgon," Activated Carbon Spec's

WITH a registered attendance of 160 members and guests America's oldest State Conference on Water Purification—that organized in Ohio in 1921—held one of its most interesting and successful meetings, on Sept. 27th and 28th, in Columbus.

On the two following days the younger Ohio Conference on Sewage Treatment held its annual meeting, which was likewise very successful. It is regretted, however, that due to lack of space the interesting proceedings of the Conference on Sewage Treatment can not be reported in this issue also.

The Retiring Chairman
E. B. Evans, Cincinnati.

The Incoming Chairman
N. J. Humason, Elyria

Business Meeting

Following Secretary Lathrop's report, came probably the most unique and witty treasurer's report ever presented. Treasurer Glenn Green (Cambridge, Ohio) gave members "something for their money" in his explanations of "how come" the Conference, for the first time in its history, had gotten in the "red"—and, to the extent of $48.00. Somebody used too much postage; somebody else did something or other, and a committee report cost the Conference a deficit—"all because a certain professor couldn't make up his mind."

Licensing Progress—Then came a report by R. W. FURMAN (Toledo), as Chairman of the Licensing Board, on progress in operator licensing under the recent Ohio regulations. Mr. Furman after explaining the new regulations, stated that some complaint had been heard concerning the stiffness of the examinations. In reply he said that the Board (operators, engineers, and a representative of the State Dept. of Health) had felt that if the certificate for Class A operators was to stand for something worthy, the necessary qualifications should remain stiff. No complaints had been registered as to the lower grade requirements.

Merger with A.W.W.A. Impractical

Reporting for the Committee on Merging of the Ohio Conference with A.W.W.A., Chairman Clarence Bahlman (Cincinnati) stated that Conference members were already to a large extent members of A.W.W.A. The benefits of a merger were recognized but, the Conference having been established as a State Health Dept. activity, the payment by municipalities of operators' expenses to attend the meetings called by the Commissioner of Health had legal status and approval of the State Auditor. To possibly jeopardize such status, by merging with the newly formed Ohio Section of A.W.W.A., did not seem advisable to the committee—at least until some further clarification of the status of expense allowances, in case of the merger, could be assured members. The committee suggested close cooperation between A.W.W.A.'s Ohio Section and the Conference, for the present an interlocking directorate, and the slogan—"Every Conference member an A.W.W.A. Member."

W. R. LaDue, Chairman of the Ohio Section, and **W. C. Lawrence,** Vice Chairman, concurred with the decision of the Committee and emphasized the fact that Secretary Lathrop of the Conference had been named Secretary of the Ohio Section; that Lawrence had been made Vice Chairman. **F. H. Waring,** Chief Engr., Ohio Dept. of Health and founder of the Conference revealed the fact that securing legalization of payments of members' expenses in attending Conference meetings had not been a simple matter; that arguments against the practice were continually recurring. To his mind, wisdom had been shown in the present decision at this particular time.

Ohio's 18th Annual Conference Group—Those Attending in Part.

H. E. Jordan, Secy. of A.W.W.A., while disappointed in not securing the full strength of the Conference in the new Ohio Section, said that there could be no criticism of the action. He hoped that Conference members would lend their best efforts to make the Ohio Section as successful and as helpful to managers and superintendents as the Conference had been to the water purification men. There was full need for activities which would bring together managers and purification men, because their interests overlapped more than ever before.

Officers Named

The following officers were named by the Nominating Committee and elected by unanimous vote:

Chairman—N. J. Humason, Supt. Filtr., Elyria

Vice-Chairman—F. J. Hull, Supt. Filtr., Ashtabula

Secretary—T. R. Lathrop, State Dept. Health, Columbus

Treasurer—F. L. Rollinns, Supt. Filtr., Barberton

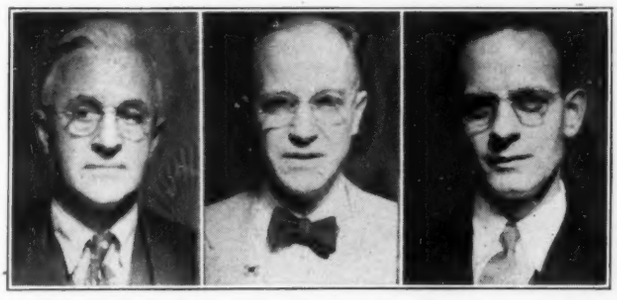
To the Exec. Committee—E. B. Evans, of Cincinnati (Retiring Chairman), and H. C. Growdon, of Portsmouth.

Technical Sessions

(Chairman, E. B. Evans, Presiding)

The technical sessions opened with the annual **"Review of Water Purification Progress and Citations from the Literature"** which for several years past has been so ably and interestingly presented by CLARENCE BAHLMAN, Supt. of Purification, at Cincinnati. With its humorous side, the reviewer told how the lowly B. Coli had, by way of distinction, been rechristened Escherichi Coli. The pronunciation's the thing, said Bahlman, but it would likely be just plain "E. Coli" to non-linguists and water works men. As to other new developments, Mr. Bahlman cited the use of carbonaceous zeolites; silicates as an aid in coagulation; Spaulding's Precipitators in softening; removal of iron as ferrous carbonate, by lime without aid of oxidation; the adaptation of limestone contact beds in corrosion control; improved methods of fluoride removal through calcium phosphate contact beds; Patrick's method of filter bed cleansing with sulphur-dioxide, etc. Concerning the most likely source of modern dysentery outbreaks (Enteriditis), there had been much discussion (mostly speculation) as to the cause. But, the cause still remained a mystery, which was another way of saying that water supplies had been put on the defensive.

"The Langelier Method of Determining the Corrosion Index" was described by CHAS. P. HOOVER, Chemist in Charge of the Columbus Water Softening Plant, who offered a set of simplified and useful graphs for arriving at Langelier's "Corrosion Index." Mr. Hoover commented that Langelier's scheme lacked in practicability because of the required chemical analyses to reveal the critical constituents such as alkalinity, calcium, free carbon dioxide and total solids. Waters of changing qualities required repeated determinations and calculations, so reference to tables, or the use of the simplified graphs developed by the Columbus staff. Its principal value lay in its availability for computing corrosivity of previous years from recorded analyses taken in connection with known conditions. For control in corrosion or encrustation prevention, Mr. Hoover felt that the simple marble test was sufficient for all practical purposes. In this opinion R. C. Bardwell, Water Engr., C. & O. Ry. System concurred, recommending the McLaughlin method. (WATER WORKS AND SEWERAGE Reference and Data Issue, April 1938, p. 422.)



Officers

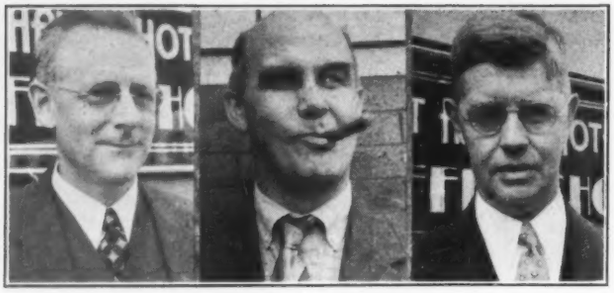
Treasurer—F. L. Rollins, Barberton.
Secretary—T. R. Lathrop, Columbus.*
Ex. Comm.—H. C. Growdon, Portsmouth.
*Also Secy. Ohio Section of A.W.W.A.

Ohio Section Officers

Chairman W. R. La Due, Supt. Water Dept., Akron, and Vice-Chairman W. C. Laurence, Water Commissioner, Cleveland.*
*A career promotion from Supt. of Filtration, since the meeting. Maybe Cleveland felt sorry for "Bill" cause he "got robbed" down at Wheeling of a portfolio without pay.

R. D. Scott, Chief Chemist, Ohio Dept. of Health, in commenting on the dependability of the marble test pointed out that very fine calcium carbonate, such as marble dust or precipitated chalk, should be employed. If the latter be used it should first be tested for the presence of free alkali. Aid should always be excluded from the contact flask or bottle. The test for pH value should be made on clear decanted or centrifugal portions, rather than filtered portions. Difference in pH value, before and after contact, had been found as important as change in total alkalinity. Based on experience, pulverized marble was preferred by Mr. Scott to chalk dust. Experience had indicated that a shaking period of 10 minutes (full flask) and finely pulverized carbonate (1 gm. to 100 cc. of water) to be ample for the waters studied. (Experience elsewhere would indicate that a longer contact period than 10 minutes of continuous agitation will be required in reaching complete stabilization when dealing with soft waters.—Ed.)

Mr. Scott said that the presence of silica would cause some inaccuracy in the Langelier calculations—17 p.p.m. $Sio_2 = .05$ error in the index. On zeolite softened waters, or well water high in bicarbonate of soda, the error appeared in the same magnitude, but in opposite direction. In comparing pH calculated by the Langelier method against pH of samples stabilized by the marble test, for waters lower than 100 parts alkalinity the calculated value is higher than observed; with waters above 200 parts the reverse is true.



Three Aces

F. H. Waring, Chief Engr., Ohio Dept. of Health (proud of the prowess of the Conference which he conceived and organized).

O. F. Scoepfle, Supt. of Filtr., Sandusky. (One of the oldest members.)

F. Dean Stewart, Waring's "Right Bower."

L. H. Enslow, Editor, WATER WORKS AND SEWERAGE, at this point offered a scheme which he suggested would meet all of the requirements stipulated by Mr. Scott, would require no filling of bottles, weighing of carbonate, shaking, or waiting. The apparatus (sketched on the board), for lack of a ready name, he would call the "Enslow Stability Indicator." It merely consisted of two vertical closed tubes conected in series. Through these, the water to be tested for corrosion or encrusting index would pass continuously, but in a fine stream so as to secure a contact period of an hour or more with precipitated chalk in No. 1 (up-flow) tube and, thereafter, with fine marble sand in No. 2 tube, preferably up-flow also. With such equipment in continuous service the pH values and/or alkalinities of samples of influent and effluent could be determined as frequently as required, and at any hour. Thus would be obviated the delay in conducting the marble test. Likewise, the use of tables or graphs requiring laborious analyses, accuracy of determinations, and avoiding likely errors in CO_2 determinations. By difference in pH values and alkalinity, at inlet and outlet of the "Stability Indicator," much could be learned to facilitate treatment control in correction of corrosion or encrustation. The pH difference would, in itself, be the true "Stability Index" without the need of factors or corrections. For temperature control the entire assembly could be surrounded with flowing water, if need be.

"Results of Dental Fluorosis Surveys in Ohio," by W. HOMER KNOX, Asst. Engr., and Dr. D. L. Houser, Bureau of Dental Hygiene, Ohio Dept. of Health, Columbus.

Mr. Knox presented some interesting, some indicative, some baffling, observations resulting from a survey to determine the safe limits of fluoride content of Ohio water supplies, if dental fluorosis (mottled enamel) was to be avoided in children. In the northwest Ohio "Fluoride Zone" communities survey used water high in fluorides; 6 others had negligible amounts.

To fully appreciate the involved analysis of statistics and evaluation of findings, the graphs with tabulated data and the discussion must be read in full—must be studied, in fact. The findings in general, according to the authors, makes it appear now that 1 p.p.m. fluorine (present as fluoride), earlier assumed as the safe limit, can now be raised to 1.5 p.p.m. without much question.

"Critical Studies in the Drafting of Activated Carbon Specifications," by L. A. MARSHALL, Supt. Filtration, and PROF. M. M. BRAIDECH, Case School of Science, Cleveland, Ohio.

This paper, read by Mr. Marshall, presents the most practical discussion, to date, of considerations to be met in evaluating powdered carbon for water purification, and the drafting of specifications which are at once practical and yet flexible enough to include all important carbon bidders. In the specifications, as finally drawn for bidding, the most pertinent clauses called for moisture content of 8 per cent or less; Phenol Value of 30 or less; odor removal values based on determination of the lowest Threshold Number per dollar of carbon required. The degree of carbon fineness was rated as a secondary consideration. In short the only two important considerations were (a) moisture content, (b) the Threshold Value index of the carbon, reduced to a dollar per million gallon basis for the particular water.

The Cleveland authorities believe the premium-penalty basis of contract to be impracticable in purchase of carbons, preferring the minimum standard contract, with an adjustment by the purveyor on any shipment under standard on the basis of necessary increased carbon requirements. In laboratory evaluations, the use of odor-concentrates was found practical. In testing samples accompanying bids, Cleveland had found three carbons with Phenol Values between 13.05 and 20.4. On the basis of cost for treatment to secure a 50 per cent and 90 per cent reduction in Threshold Value the variation was $15.27 to $22.62 per million gallons, the contract going to the $15.27 carbon regardless of its position on the Phenol Value scale.

Two carbon manufacturers' representatives were invited to discuss the Cleveland procedure. **H. F. Sloan,** Cliffs-Dow Chemical Co., Marquette, Mich., said that they would favor more of the "give and take" in the contract. If there was to be a penalty for dropping below the minimum on one shipment, a premium allowance should be made on following shipments, to cancel the penalty in part if not in to-to. **R. N. Statham,** Industrial Chemical Sales, Cleveland, considered the residual Threshold Value an interesting standard but felt that the laboratory dosages required, and costs cited, were higher than would be experienced in the plant. Both representatives agreed to the moisture limit.

(1) L. L. Hedgepeth, Director Tech. Service, Penna. Salt Co.; (2) J. H. Bass, Asst. Engr., Ohio Dept. Health; (3) J. A. Nicklis, W. & T. Co., Columbus; (4) Tommy Tristram, Supt. Filtr., Lorain (charter member); (5) A. J. Miller, Supt. Water, Elyria; (6) F. S. Taylor, Supt. Filtr., Defiance; (7) R. F. MacDowell, Cons. Engr., Cleveland; (8) R. J. Faust, Asst. Engr., Mich. Dept. Health, Lansing, Mich.; (9) C. S. Finkbeiner, Cons. Engr., Toledo.

New Information on Precipitators

"The Behavior of the Precipitator in Softening Water," by CHAS. H. SPAULDING, Supt. of Purification, Springfield, Ill.

Mr. Spaulding, designer of the novel "Precipitators" at the Springfield Softening Plant, now with operating experiences on which to base judgment concerning the optimum depth of blanket of precipitate (sludge) to maintain, its best density, and contact periods most effective, presented data of interest on these important points.

Having operated with various depths of sludge blanket, it had been found that a blanket of 7 ft. depth proved satisfactory. The deeper the blanket the more effective the clarification, up to 12 ft. depth at least. Especially so with water at Winter temperatures. As to the optimum sludge density, between 0.1 and 5 per cent solids had been tried. Seemingly, maintaining solids (precipitate) above 2 per cent in the sludge zone began to yield a more turbid effluent and 1 per cent solids appeared to be the practical minimum. Example: with 1.5 per cent sludge the residual turbidity of effluent was only 0.2 p.p.m. Concerning retention periods—in warm weather a 45 minute period (2½ gal./min. for each sq. ft. of water surface area) had been satisfactory. However, for low temperature operation the full design period of 90 min. (1¼ gal./sq. ft. water area) proved of advantage. It was to be remembered, however, that 50 per cent of the volume of the Precipitator was taken up with floating sludge.

The ability to produce a finished water with a total hardness of 36, from a raw water of 170, without recarbonation was reported by Mr. Spaulding, as the latest development of interest. The scheme involved excess lime treatment to take down the magnesia, plus the use of bicarbonate of soda ($NaH\ CO_3$) for a dual purpose. First, it replaced soda ash for taking down the non-carbonate (permanent) hardness; secondly the ($H\ CO_3$) ion served the same purpose as CO_2 gas does in recarbonation—namely, the precipitation, as $Ca\ CO_3$ of all excess free lime. The Springfield water as now produced (lime and coagulant) ran a total hardness of 85 parts—recarbonation being unnecessary with the Precipitators. With bicarbonate treatment production of water of 34 total hardness (36 alkalinity) had been demonstrated. Mr. Spaulding said that many plants could adopt the bicarbonate treatment with profit. Especially did he advocate its use in small plants because of the overall economic aspects of the method in such plants, as well as its simplicity of control.

Jas. A. Montgomery, Consulting Engr., Columbus, Ohio, revealed some interesting results with a Spaulding Precipitator in tests made for the Southern California Metropolitan Water District on the very turbid Colorado River water (375 p.p.m. hardness) at Boulder City, Nevada. In these tests 15 min. rapid mix and 45 minute detention in the Precipitator proved ample. The chemical reactions were found 100 per cent completed within the sludge blanket, which he likened in principle to the marble-test of the laboratory. From 0.8 to 1.5 per cent of precipitate in the blanket proved the optimum limits. Sludge blow off amounted to 8/10ths of 1 per cent of the water treated. The precipitate was of granulated (crystalline) structure, rather than the usual sticky amorphorus nature of softening sludges. With exact coagulant control, residual turbidities in the Precipitator effluent could be dropped to 2 p.p.m. Several plants to use the principle of the Spaulding Precipitator were under construction in Ohio. (It appears that the floating precipitate effect produces water more of the nature of softened water which has been filtered; also comparable to water softened by the hot process employed in the industrial field.—Ed.)

Clarence Bohlman, Supt. Filtr., Cincinnati. (No. 1 Progress Reviewer.)
Hayes Kuhns, Leadite Co., Columbus. ("Rooting-Tooting" Member Getter for new Ohio Section.)
Charlie Spaulding, Supt. Filtr., Springfield, Ill. (Invented world's largest marble-tester; named it the Precipitator.)

"Experiences With a Carbon-Hydrogen Zeolite Unit for Recarbonation," by R. D. SCOTT, Chief Chemist, and J. H. BASS, Asst. Chemist, Ohio Dept. of Health.

This paper, presented by Mr. Bass, constituted a brief description of the small Hydrogen (Carbon) Zeolite unit at Mt. Victory, Ohio, installed for the purpose of treating a fraction (about 10 per cent) of the raw water for CO_2 production and admixture later with the excess lime treated fraction (90%) to secure recarbonation effects along with hardness reductions. In regeneration of the carbon bed 66 degree sulphuric acid cut to 1½ per cent H_2SO_4 content with water was used, the pressure unit being a rubber lined tank and contact period therein being 50 minutes. The acid charge is re-used to almost exhaustion. At Mt. Victory the miniature plant treats water for a population of only 500, reducing a well water from 400 to 100 hardness. The advantages cited for the novel recarbonation scheme were (1) flexibility, (2) compactness, (3) ease of control and adjustment, (4) low maintenance cost. Disadvantages were (1) addition of sulphate hardness, (2) handling of sulphuric acid, (3) adaptability only to clear waters with principally bicarbonate hardness. The cost had been $1.20 per m.g. for the acid required.

J. A. Montgomery pointed out that essentially distilled water was being produced with the combination of hydrogen zeolite, aeration, or degassing, and finally resin zeolite units in series, the latter being regenerated with caustic soda.

R. C. Bardwell commented that two railroads were now producing Montgomery's "distilled" water for use on stream-liners.

"Performance of Zeolite Plants," by H. M. OLSON, Chemical Engr., Ohio Salt Co., Wadsworth, Ohio.

Mr. Olson's paper constituted a review of performance of 27 zeolite plants serving municipalities in Ohio, W. Va., Pa., and presented something of the costs. He concluded by naming the several well defined advantages from the zeolite softening process, with especial reference to the ease of control, flexibility, and the automatic features of particular interest to small communities.

Edw. Smith, Supt. Water & Sewage, Lima.
C. O. Hostettler, Plant Chemist, Akron.
J. S. Gettrust, Supt. Filtr. & Pumping, Akron.
(Converts waste steel mill liquors into "Chlorinated-copperas"; reduces stream pollution, saves money.)

Overall economy of installation and operation and maintenance; absence of sludge problems and recarbonation problems, and after deposits in mains, were stressed. In addition the water produced was tastier than lime softened water.

In reply to a question—"What about the corrosion aspect of zeolite waters?"—Mr. Olson recommended a final water of 60 p.p.m. or better residual calcium hardness treated with silicate of soda to produce pH 7.6 to 7.8, for stabilization.

It was pointed out by **T. R. Lathrop** that automatic zeolite plants could only be economically successful with water of fairly constant characteristics. **R. J. Faust** (Michigan Dept. Health) wanted to know if natural salt brine could be used in regeneration. Mr. Olson replied by citing a case where $13,000 annually was saved by use of salt well brine in Pennsylvania.

R. C. Bardwell warned that zeolite water of very low hardness residual had a great avidity for metal pipes—especially hot water systems with which he had had sad experiences. To this, **R. F. MacDowell,** Cleveland Cons. Engr., replied that municipal plants had not the same problem as cited. Experience with partial softening, meeting domestic requirements, had shown that caustic soda and silicate treatment to be an effective corrective at reasonable cost.

Putting the "Hex" on Scale Formation

"Experiences With Hexa-meta-phosphate in Municipal Softening," by CHAS. P. HOOVER, Consulting Chemical Engr., Columbus, Ohio.

Mr. Hoover's discussion of the effectiveness of minute dosages of Hex-meta-phosphate to softened waters, for prevention of encrustating deposits forming in mains or household piping, constituted a presentation of exceptional interest. The simple treatment described bids fair to go far in production of non-corrosive but stabilized waters with simple softening. The material employed bears the trade name "Calgon" (interpreted as "calcium gone"), and has already established its merits in industrial water treatment.

Mr. Hoover reviewed experiences with the use of "Calgon" at the softening plants of Delaware and Mt. Sterling, Ohio, where astonishing results had been observed. First, the dissolved salt had been applied to the water entering the filters. A dosage of 2 p.p.m. immediately stopped plating out of calcium carbonate on the filter sand to the extent of roughly 40 tons per year. Since this effect defeated the prevailing softening effect by the sand-beds, treatment was changed to the filter effluent as the more correct point. Advantages cited were (1) the non-necessity of recarbonation; (2) a uniform water in the distribution system; (3) possibility of carrying high pH water in mains, without excess encrustations near the plant, or chokage of hot water systems. In the final analysis 1 p.p.m. of "Calgon" appeared sufficient for stabilizing the filtered water. Even boiling had not produced a precipitate in water so treated.

At Mt. Sterling 2 p.p.m. "Calgon" had stopped scale deposition from a 5 grain hard water in hot water pipes. Specimen of pipes handling "Hexed" and non-treated water revealed the marked effectiveness of "Calgon" application, thought to be probably twice the eventual dosage to be required. Mr. Hoover explained that such was the beginning of more detailed studies.

Owen Rice, Chemical Engr., Hall Laboratories, Inc., Pittsburgh, Pa., contributed an eye-opening discussion revealing the many interesting, but little understood, effects produced by minor dosages of "Calgon" recently introduced into water treatment by Hall Laboratories, Inc. The formula for the material (hexa-meta-phosphate) is $(Na\ PO_3)_6$—one of the phosphate glasses. Mr. Rice showed, by pictured history, that "Calgon" treatment had actually disintegrated old scale deposits in hot systems, while acting as a scale preventive also. At Mt. Sterling indications were that 0.5 p.p.m. treatment would be ample. It was desirable and economical to use barely enough to produce a Threshold Treatment which would be lightly scale depositing during a fraction of the time.

Mr. Rice pointed to the potentialities of "Calgon" in corrosion control, involving lime treatment to a stabilizing pH value without precipitating carbonate pronouncedly near the plant while experiencing corrosion on the far reaches of the system. With 2 p.p.m. applications it would be possible to maintain a pH value throughout the system, essentially where found to be required. In this control scheme Enslow's "Stability Indicator" would prove the efficacy of treatment and constitute a valuable tool in effective and economic dosage control.

In reply to questions, Mr. Rice stated that "Calgon" was at present priced at 17½ cents per lb., in 400 lb. drums f.o.b. Chicago. He would estimate 1 p.p.m. enough for hot water control at a cost of $1.25 per m.g., or one-half that for cold water control alone. The material, being so very soluble, could be stored as a 70 per cent solution in steel or concrete. It was now proposed to market 50 lb. drums to small users. The solution or the pulverized material would not deteriorate within one year.

R. C. Bardwell, Supervisor Water Supplies, C. & O. Ry., commenting on 18 months' experience with "Calgon" treatment, felt it the "answer to a maiden's prayer." First tried at 4 p.p.m. it had cleared out scale

Owen Rice, Hall Laboratories, Pittsburgh.
A. E. Kimberly, Consulting Engr., Columbus.
J. M. Montgomery, Consulting Engr., Columbus.

in hot limes; later, reduced to 2 p.p.m. with continued effectiveness. In cold limes it had not removed scale but had stopped deposition and caused old scale to become porous or mushy, and easy to remove mechanically.

F. N. Speller, Corrosion Expert, National Tube Co., invited by the Chair to comment, stated that he considered "Calgon" as revolutionary in water treatment as had been Tetra-ethyl-lead in the automobile field. In every case of corrosion control we landed right back at the criterion—protective film production. In this, "Calgon" seemed to give uniformity of positive film production without over-production. The question now was what effect "Calgon" treatment would have in respect to brass and galvanized pipes. Would these be protected against the high pH effect in taking the zinc from such pipes? What effect, if any, on cooking of foods?

Mr. Rice replied that, with proper control, possibly the answer would be no deleterious effects, but that this phase needed further investigation. From the physiological angle, medical laboratory researches had indicated no untoward effects beyond a slight physicing, such as phosphates generally produced. In reply to another question, he said that "Calgon" for scale prevention recirculated cooling waters had been effectively used for 3 years in Diesel installations and steam condensers. The quantity required was 2 lbs./day per K.W. produced per day.

F. H. Waring, Chief Engr., Ohio Dept. of Health, remarked that the State's policy in regard to chemicals going into potable water supplies was to require adequate proof of physiological safety before approved usage could be secured. Mr. Rice's firm had been prompt to secure evidence of the non-harmful effects of "Calgon" before the Ohio tests were permitted. Materials (notably chromates) advocated by some other firms, had not been approved for the reason cited. A satisfactory stabilizer for use in the many Ohio softening plants was a welcome material.

"Experience With Lignin-Phosphate Treatment," by C. L. CROCKETT, Chemist, Norfolk and Western Ry. System, Roanoke, Va.

Mr. Crockett reviewed experiences with National Aluminate Co.'s lignin-phosphate treatment in clearing a severely encrusted main, requiring booster pumping to overcome head-loss. Experiments proved the treatment capable of loosening the scale, so application at a ¾ gr./gal. rate was started. Samplings and analyses proved scale to soon be clearing up at the rate of 1,500 lbs. per million gallons of treated water passed. After two months the rate had descended to 750 lbs./m.g. and now after seven months was but 400 lbs./m.g. It was therefore possible to calculate complete removal of 130 tons of scale in 18 months. Fire hydrant flushings had proved helpful in loosening the mushy-like scale after transformation from its crystalline structure. At Welch, W. Va., for three years the same treatment had completely eliminated previous monthly cleaning of piping in a recirculation system piping.

In reply to questions, Mr. Crockett stated that the lignin would likely render the material unsatisfactory in potable water treatment. The material employed was National Aluminate Co.'s No. 8 Treatment.

Spent Pickling Liquor as Coagulant

"The Use of Chlorinated Ferrous Sulphate for Coagulation at Akron," by J. S. GETTRUST, Supt. Filtration, and C. O. HOSTETTLER, Chemist, Akron.

F. N. Speller, National Tube Co., Pittsburgh.
C. L. Crockett, Chemist, N. & W. Ry., Roanoke, Va.
E. P. Partridge, Chem. Director, Hall Labs., Pittsburgh.

The paper presented by Mr. Hostettler revealed the money saving scheme at Akron in the production of coagulant from spent pickling liquor hauled from a nearby steel mill. The ferrous solution was chlorinated as fed to the water, thus producing an acidic rapid acting chlorinated copperas solution. Otherwise dumped to waste the liquor had been secured merely for the cost of haulage in a tank truck.

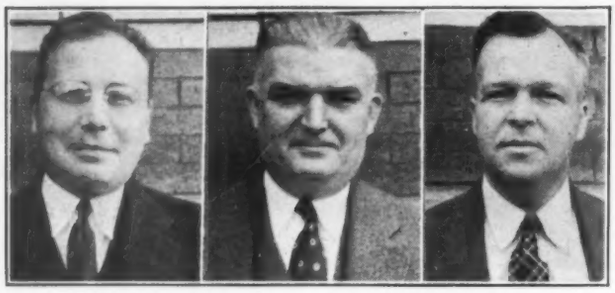
Especially valuable, said the authors, had been the oxidized iron and acidic solution when the alkalinity of the raw water and the color was up on account of dry weather. Under such conditions it had been proven more effective to secure low pH coagulation first and follow with lime later in the mixing chamber, to effect a pH of 7.4 to 7.6. When the raw water dropped to minimum color and alkalinity (least buffered) a combination dosage of 33 per cent filter alum and 66 per cent iron sulphate (chlorinated) had proved effective. The new treatment had resulted largely because of "smoky" effluents with alum and lime, whereas color removal resulted. Lantern slides revealed the method of hauling, storage and feeding of the waste iron liquor; also the scheme of chlorinating. The whole scheme, said the authors, had proved simple and flexible, which made the economy of using the waste material the more pleasing.

In reply to a question, Mr. Hostettler said that the extra acidity of the liquor was a decided asset in coagulation. The extra lime required over that required with alum amounted to only 0.25 grains/gallon, a negligible item when considering the overall results.

Clarence Bahlman (Cincinnati) in his own experience confirmed the fact that unchlorinated iron sulphate lacked in efficiency during certain river stages. In the Akron scheme the chief question would be the dependability and continuity of the iron liquor supply. At Cincinnati much trouble from sugar-copperas caking in the bins had been experienced until specifying an overdried product, wherein roughly 5 per cent of the water of crystallization had been expelled from the ($Fe\ SO_4$: $7\ H_2O$) grains.

"Explanation of B. Coli Reporting in Terms of Most Probable Numbers," by E. B. EVANS, Sr. Chemist, Cincinnati.

Mr. Evans explained the modern method of Calculating and recording the most probable numbers (M.P.N.) of E. Coli, nee B. Coli, as compared to the older method of reporting indicated numbers (I.N.). Although daily results and monthly averages by the two methods had failed to check, the (M.P.N.) and (I.N.) values had checked very closely in computing longer period averages and the (M.P.N.) scheme was to be considered the more scientific and accurate of the two. The computa-



Paul Miller, Matheson Alk. Wks., Cincinnati.
Paul Martin, Neptune Meter Co., Columbus.
F. P. Fischer, Wallace & Tiernan Co., Cleveland.

tion was not complicated, but the number of dilution tubes set up would have to be greater for (M.P.N.) reporting.

In reply to a question, T. R. LATHROP said that the State Health Department had no particular preference for one method over the other.

Round Table Topics

"Here and There—Some Observations," by CHARLIE HOOVER, might have been the title of a running account by Mr. Hoover, of things seen in the field during his recent cross-country trip to the West Coast.

(1). At **Oklahoma City** he found a former Columbus boy doing interesting things. L. H. SCOTT, Supt. Purification, had developed a unique scheme of returning softening sludge. Rather than to the raw water direct, some went through the lime slakers and the balance to the lime suspension from the slakers. The results had been rather remarkable, resulting in a clear cut rapid precipitation of crystalline nature, resulting in a more stable clarifier effluent of high clarity and leaving but little to be attained in the subsequent recarbonation.

Another Scott development had been the vacuum filtration, drying and burning of sludge in a Nichols-Hershoff Furnace on a pilot-plant scale. In reality a lime factory was in the making at Oklahoma City which would produce an excess over plant requirements for possible use in sewage treatment and sludge dewatering.

A third Oklahoma City development, of marked interest, was the plant scale installation of under-water gas burners, producing effective recarbonation in a very small area with a short gassing period.

[Such burners have for some time been employed for their high heating efficiency in evaporation in the chemical industry. For carbon dioxide production and utilization the application would seem to be as novel as it is economical.—Ed.]

(2) In the **Los Angeles Water Dept.** he found Goudey applying copper-sulphate on the basis of intensity of the ultra-violet light in Southern California's eternal sunshine, effecting therewith a 20 per cent saving in cost of coppering. Apparently there was sunshine and *sunshine* in the Los Angeles area. In place of handling scads of cotton plugs resulting much waste material, the laboratory was using long bottle caps of aluminum over the tubes, with success and economy. "Annite," a ground cotton-seed product, was being used in dish washing.

(3) At the **University of California** he had found Prof. Langelier working on a new device for determining soap-hardness at the surprising speed of about 50 determinations per hour. Total solids were being determined by conductivity measurement with the use of factors. An improved colorimeter for pH determinations had also been perfected. Mr. Hoover added that soap solutions, for hardness tests, would not precipitate with age if chilled in the ice box and filtered prior to standardization.

"Electro Rust Prevention for Water Tanks," by O. B. HESS, Supt. of Water, St. Clairsville, Ohio.

Mr. Hess described a form of cathodic-protection being applied to prevent corrosion of the interior of water tanks. The equipment involved, which seemed markedly simple, had been installed on trial by the Electro Rust-proofing Company of Dayton, Ohio. From a vertical stainless steel cylindrical electrode, hung at tank center, D.C. current flowed radially to the tank walls. The compact rectifier converted 110 volt A.C. to D.C. of 1 amp. flow at 14 volts. After 3 months of operation the results had been surprising. The tuberculation and rust had dropped away and grey iron now appeared with a slight film over it. Based on such results, the city had purchased the equipment for $325 installed. At 2 cents per K.W. the monthly current bill had been 40 cents, but Mr. Hess added that he understood that with larger tanks current costs would be proportionately higher. Theirs was only a 200,000 gal. tank, which had not been recoated for 9 years, and was badly in need of renewed protection.

O. C. Gohlke, Supt. Water and Sewage, Findlay, Ohio, stated that they had had a similar installation in service on a wash water tank since February and their experiences were essentially the same as reported by Mr. Hess.

L. L. Hedgepeth, Pa. Salt Mfg. Co., Philadelphia, added that strong acids were now being transported in steel truck-tanks protected with a like scheme of cathodic protection, the current being taken from the ignition system.

Experiences with Silicate Treatment

At **Lima, Ohio,** E. E. SMITH, Supt. of Water and Sewage, reported that preliminary results indicated that a dosage of silicate of soda amounting to one-third of the alum dosage seemed likely to reduce coagulation costs by 50 per cent.

At **Toledo, Ohio,** R. W. FURMAN, Supt. of Water, stated that tests involving silicate had been underway. Results had been an improved and faster flocculation, at a cost not exceeding that of alum alone. At 7.5 pH (minimum permissible), and at temperatures below 45 deg. F., results with silicate and alum had been superior to alum, with or without lime. Comparing the scheme of Graf (St. Louis) with that of Baylis (Chicago) had shown results with the Baylis method to be more effective for the Toledo water. Mr. Furman added that the results would be considered impressive, even if the coagulant economy noted had not resulted.

R. W. Ockerhausen, General Chemical Co., Chicago, cautioned that shortened filter runs had resulted from the use of silicate. The silica had apparently precipitated out in the filter beds to cause the chokage.

Dayton in April

N. B.—The first meeting of the new Ohio Section of A.W.W.A. (being planned as a "Conference on Water Works management") was announced by Chairman LaDue as having been scheduled for Dayton, Ohio, on April 27 and 28, 1939. Hayes Kuhns, New Member Committee Chairman, around selling A.W.W.A. memberships, as well as a well known joint compound, guaranteed a big meeting in Director Moorehouse's home town.

N.E.W.W.A. CONVENTION PROCEEDINGS

Part 2—Digests of Papers and Discussions

THE first installment of this report, covering the 57th Annual Convention of the New England Water Works Association, ran in our October issue. This is the second and concluding installment.

Reliability of Double Check Valves

"Double Check Valve Maintenance and Tests"—by FREDERICK O. ALMQUIST, SR., Sanitary Engr., Conn. State Dept. of Health, Hartford, Conn.

Mr. Almquist's paper constituted an interesting review of experiences with, and history of, the performance of 151 double check valve installations in Connecticut, de-

Edw. F. Morgan, Jr.
Hudson, Mass.
(Chairman, Sup'ts.' Session)

Edw. F. Moore
Harvard University
(Chairman, Chemists' Session)

pended upon for safeguarding public water supplies against pollution from cross connected industrial supplies. Specifications and design requirements for such installations were reviewed and the procedure in making inspections and tests outlined, all such tests being made in the presence of the superintendent of water works, a manufacturer's representative, and engineer of the State Dept. of Health. Tests for leakage past both checks are made every four months, the valve covers being removed for complete inspection once yearly. The history from a total of 6,823 recorded tests, during an 11-year period, indicated that in no single case had the flaps of both checks on an approved F.M. type installation been found to be leaking simultaneously. In 122 cases the outside (city side) check had been found leaking and in 17 cases the check on the mill side was leaking. Experiences had indicated the need for placing the checks in a level position for best flap seating. In his conclusions (based on 12 years of systematic checking) Mr. Almquist pointed to the great degree of reliance of present day approved installations of double checks. Thus was indicated the value of the routine testing and yearly inspection and cleaning provided. This did not mean, however, that such physical connections would now be permitted in the state, beyond the 151 active installations (162 earlier) in existence at the time of enactment of Connecticut's prohibitory regulations pertaining to industrial cross-connections.

"Experiences with Check Valve Tests in New Bedford, Mass."—by STEPHEN H. TAYLOR, Supt., Water Department, New Bedford, Mass.

Mr. Taylor reviewed records of double check valve tests in New Bedford, covering 85 installations (involving 1,694 tests) during a five-year period. In no instance had both checks been found leaking at the same time. The chief cause of leakage had been found to be tuberculation of the iron body of the valves and resultant interference with tight seating of the rubber gasketed flap. The safe life of the rubber gasket had been taken as 10 years, with renewals made accordingly. Taking other records covering earlier years, together with the 5 years cited, the chances that both checks would be found leaking simultaneously appeared to be about 1 in 1400 times.

H. E. Halpin, Engineer, Factory Mutual Insurance Co., Boston, Mass., stated that although the records of the all-bronze double check F.M. type installations had been extremely satisfactory there had been no let up on maintenance. Rubber gasket replacements had been every third year, although 7.5 year life seemed a safe span of use.

Concerning the question of tuberculation (responsible for 54% of the leaking flaps in New Bedford) suggestions of correction from the floor included cement or bituminous linings. Also, the possibility of "metallizing" valve interiors by the hot metal spray-gun method was suggested.

F. H. Kingsbury, Mass. Dept. of Health, stated that Massachusetts' regulations required monthly tests on double check valves by the owners, plus quarterly tests by the local water works. Once yearly a Health Department representative observed such tests. Mr. Harrington added that the Mass. Dept. of Health now maintained records on 450 installations of double checks, with the number constantly growing.

A. O. Doane, Cons. Engr., Newtonville, Mass., stated that tuberculation was intensified at point of bronze seat and C.I. contact and suggested a raised seat for greater safety, or an all-bronze valve.

"Fred" A. O. Almquist, State Dept. Health, Hartford, Conn.
Maurice A. Libby, Supt. Water District, Bath, Me.
"Hap" W. Ford, Pittsburgh-Des Moines Steel Co., N. Y. City.
(President-elect, Water Wks. Mfgrs. Ass'n)

History and Development of C.I. Pipe

Wm. R. Conard, Engineer and Consultant, Burlington, N. J., introduced the topic, "History and Development of Cast Iron Pipe," with an interesting historical account of the earliest production and adaptation of cast-iron pipes, dating back to 1722 in France; 1740 in England; 1800 in America. Until 1803 all cast-iron pipe used in America was imported pipe. It was

(1) *Frank Brainard, Jr., Brainard & Co., Hartford, Conn.;* (2) *C. W. Martina, Sparling Meter Co., N. Y. City;* (3) *S. F. Ferguson, Pres., Water Leak Detector Co., Columbus, O.;* (4) *Arthur Taylor, Ludlow Valve Co., Boston;* (5) *Geo. C. Houser, Metcalf & Eddy Engrs., Boston;* (6) *Charlie Crump, Devonshire-Artic Chemical Co., Boston;* (7) *Henry N. Armbrust, Proportioneers, Inc., Providence;* (8) *Robt. Mannheim, Mathieson Alkali Wks., Providence;* (9) *A. E. Griffin, Wallace & Tiernan Co., Newark, N. J.*

this year that the first foundry was established in Millville, N. J. Early pipes were flange or socket jointed, resulting in considerable dissatisfaction and leakage until Simpson, a British engineer, in 1786 perfected the bell and spigot joint poured with lead. This put cast-iron pipe on its feet, so to speak, and the next major development was DeLavaud's centrifugal process of production, now about 20 years old. Not until 1902, however, were there standard specifications for cast-iron pipes, such being adopted by the New England Water Works Association that year. Later A.W.W.A. set up its specifications, and now under development is what is to be known as the "American Specifications." Pointing to the importance of cast-iron pipe in water supply, Mr. Conard cited its long life—500 years being predictable—and the fact that the mains represented by far the largest capital investment in water works systems.

"Pipe and Public Welfare" was the title of a costly motion picture, dramatizing the history and service of cast-iron pipe to man. This picture, a production of The Cast Iron Pipe Research Association, also brings in the technical attributes of cast-iron pipe by dramatizing shop and laboratory tests and foundry control procedures. In the end the consulting engineer, too, comes in for his share of glory before a scrappy tax-payers meeting which backs him up by voting in his recommendations that cast-iron pipe be employed.

Filter Plant—Water in Air Conditioning—Fire Protection

"Biddeford's New Filter Plant"—by EDWIN T. MCDOWELL, Supt., Biddeford and Saco Water Company, Biddeford, Me.

Mr. McDowell described the new 8 m.g.d. (6 unit) filter-plant, placed in service in 1937 at Biddeford, Me., to replace an old 4½ m.g.d. plant containing 22 wood-tub filters. Some of the unique features follow. To preclude interference or damage from flood-waters of the Saco River the entire plant and pumping station is set within a reinforced concrete "box" extending well above the record flood-mark of March, 1936, which had come on them as a lesson during construction. Thus, there is an air space between all filter or basin walls and the enclosing structure, thereby protecting all water-bearing structures against frost damage so frequently noted on sweating or seeping walls in cold climates.

The open top coagulating basin (5 hr. detention) is covered with a brick super-structure, heated by steam to prevent freezing. Baffling is arranged to slow the velocity from inlet to outlet. Another feature is the filter underdrain system of 2½ in. copper tubing drilled with 5/16-in. holes looking down. The wash water troughs, of unique design, are constructed of copper-bearing steel. The Saco River is extremely soft (7.5 ppm. total hardness) and colored. Corrosion correction is the principal problem which is yet unsolved. Addition of soda ash to raise the pH values higher than 7.5 has produced taste complaints and proved costly in addition, Mr. McDowell stating that this was the only disappointment in plant operation. Other methods are being investigated. The plant was designed by Burgess and Niple of Columbus, Ohio.

"Use of Cooling Water in Air Conditioning"—by W. H. SEARS, Mech. Engr., Metropolitan Water Supply, Boston.

Mr. Sears' paper, read by E. S. Chase, proved to be essentially a review of what has been published on this topic in the past two years. In it the author pointed out the marked reduction in water demand for modern refrigeration unit cooling. Now fully conserving installations required an average of 2 gals./capita per day for the entire year, i.e., 780 gals. per year available additional supply per capita. The peak demand, so much more important, had been gotten down to 15 gals./capita/day.

In estimating air conditioning he had used records of H.P. sold for air conditioning, as a figure readily obtainable from the electric utility. Each 5 persons served required 1 H.P. of current demand. In Boston such records, (14,700 H.P. for air cooling) had revealed an estimated total water demand of 1.8 gal./day per person and a peak demand of 12.6 m.g.d. per person. These figures had been computed on the assumption that 50 per cent water conservation equipment is involved.

It was Mr. Sears' opinion that water utility managers

Snapped on the Boat Ride

(1) *Mr. and Mrs. Elwood N. Smith, Hersey Meter Co., Boston;* (2) *W. H. Johnson, V.-Pres., Phoenix Meter Corp., Staten Island, N. Y.;* (3) *Col. W. F. Rockwell, Pittsburgh-Equitable Meter Co., and Ross S. Scott, S. R. Dresser Mfg. Co.;* (4) *"Vic" Arnold, Pres., Phoenix Meter Co., and Mrs. "Vic";* (5) *Sloane and Brainard—"Big Applers Extraordinary" —throw the candidman a pair of pretty smiles.*

should find a way not to discourage water sales, even if a "demand-charge" be required, such as employed by electric utilities. He believed that water for air cooling and comfort should rank with that supplied for other health conveniences.

"Modern Fire Pumpers and Their Influence on Water Works"—by Geo. W. Booth, Chief Engr., National Board of Fire Underwriters, New York.

Modern fire pumpers, said Mr. Booth, now had 750 g.p.m. capacities with a trend toward use of 1000 to 1500 g.p.m. pumpers. Such increased streams meant increased maximum water demands, but such pumpers needed only 10 lbs. residual pressure whereas 50 lbs. would otherwise be needed. Now 750 g.p.m. hydrant yield was the required minimum (1000 g.p.m. in some cases) and such would probably result in improved hydrants, limiting pressure loss to 20 lbs. at 1000 g.p.m.

Mr. Booth also stressed the value of storage on opposite ends of arterial systems, stating that 1 m.g. storage was equivalent to adding an extra 12 in. main through the community; 2 m.g.d. capacity storage being equal to an extra 16 in. main. Now, 8 in. pipe had become the minimum size recognized; also, gating so that the shutting of 2 valves would shut off any hydrant on the system.

Superintendents' Session

(Chairman—Edw. F. Morgan, Jr., Hudson, Mass.)

As customary, the closing session was devoted to topics of particular interest to superintendents, while in an adjoining room the chemists held a parallel session on treatment topics.

"The Automatic Diesel Pumping Stations of Needham" — by Roger W. Oakman, Supt. Water Department, Needham, Mass.

Mr. Oakman described the two automatically operated pumping stations of Needham, equipped with Fairbanks Morse Diesels and 1 M.G.D. deep-well turbines, placed in operation January, 1937. A heat exchanger built into the pump discharge line cools the engine cooling water, recirculated at a rate to produce a heat pick-up of only 5 degrees F. The station, being unattended, is thoroughly equipped with automatic controls to stop the engine should cooling water temperature exceed the normal, or should the lubricating oil pressure drop. Twice, said Mr. Oakman, the thermal control had functioned to stop the engine. However, because of continuous operation, an inspection of both stations is made at 4-hour intervals between 8:00 a. m. and 10:00 p. m. and at 2:00 a. m. by a police patrol car operator.

Concerning operating experiences, the engine once developed a knock which was traced to carbon chokage in the air intake ports. This justified the first pulling of the pistons after the 9,200 hours of continuous operation. Since, it has been decided to pull the pistons every 6 months for overhaul and inspection. The schedule also calls for monthly shutdowns of about 4 hours for cleaning combustion chambers, exhaust ports, all filters and strainers. After 18 months of operation piston rings were replaced for the first time, and this was sufficient to cause Mr. Oakman to give Atlantic Refining Co.'s lubricating oil a boost. An interesting effect from paralleling of existing mains leaving the station, with new mains, had been the boost in output from 308 g.p.m. (440,000 g.p.d.) to 538 g.p.m. (775,000 g.p.d.). They contemplated a further boost to 900,000 g.p.d. after completion of the main betterment program.

At the Chemists' Session
F. A. Abbiati, Monsanto Chem. Co., Boston
E. N. Shelton, Tennessee Corp., Atlanta
E. A. Sigworth, Industrial Chem. Sales, New York

As to operating costs; when pumping at the 308 g.p.m. rate, before main enlargement, (with fuel at 6½ cents and lubricating oil at 42 cents per gal.) the cost had been $9.14 per m.g.; against the reduced head (538 g.p.m. delivery), only $6.50 per million. By comparison, purchased electric current for pumping in 1935 ran to $33.00 per million and in 1936 to $38.00 per million. Fuel oil consumed per water horse power had been 0.494 pounds against the guarantee of 0.507 pounds. Mr. Oakman presented a breakdown estimate indicative that the full cost for pumping with Diesel power would average only $9.25 per million for the whole year 1938. From the projected saving of $8,500 in two years, such would be sufficient to pay for the installation in three years. Mr. Oakman pointed out that at a cost of $133.00 per year insurance carried against equipment breakdown was considered prudent protection.

In answer to questions, Mr. Oakman stated that labor costs in operating electric or Diesel stations would be but little different. Power rate had been 2 cents per K.W.H., but since planning the new station a rate was made which would have reduced pumping costs to roughly $16.00 per million. The insurance covered all replacement of damaged equipment and labor required.

Frank Flood (Metcalf and Eddy Engrs.) stated that a study of the situation at Needham had indicated that with power at 1.7 cents per K.W.H. the overall cost of maintaining and operating an electric and Diesel station would be about even.

Roger Esty (Supt. Danvers, Mass.) recited an experience to show the value of good lubricating oils and stated that even a threat of "Diesels for Danvers" had saved the city $1,700 per year.

Donald C. Calderwood (Asst. Supt., Nashua, N. H.) stated that the Nashua Diesel installation was a stand-by job, paying its way in the elimination of stand-by electric charges resulting from the installation. Actual

W. T. Thornhill, Vice-Pres., Wailes, Dove-Hermiston Corp. (Unlined pipes soon to be the exception.)

Roger C. Oakman, Supt., Needham (Mass.) Water Dept. (His Diesels keep Needham's dollars at home.)

D. R. Smith, Director of Works, St. Johns, N. B.
Edw. R. Stapley, Okla. A. & M. College, Stillwater, Okla.
Daniel J. Saunders, Permutit Co., New York

operating costs had not been far different from costs of pumping with electric power at Nashua.

"Why Line Pipes—Old and New?"—by W. H. THORNHILL, Vice-President, Wailes, Dove-Hermiston Corp., New York City.

Mr. Thornhill, in the audience but handicapped with a cold, had a pinch-hitter in the person of Geo. E. Boyd, of the same company, who presented his paper. In answering the question "Why Line Pipes?" Mr. Thornhill listed 6 reasons. In addition to protection of the metal, chief amongst the reasons was the fact that increased pipe line capacity allowed for greatest economy in design. Pointedly so when realizing that capacity and low friction today would be that of the many "tomorrows" in years to come, regardless of the aggressivity of the water or methods of treatment. Another reason, constancy of friction losses, allowing selection of the most efficient pump for the present, and for years to come, without specifying so as to take into account a friction built up with increasing age of mains. Stressed was the 145 to 155 coefficient (C value) of the mirror surface of bituminous enamel lined pipes, as compared with 130 to 140 for cement linings or concrete pipes, and 125 for ordinary tar dipped pipes when new. Realizing the high cost of unbelievably slight tuberculation in producing friction loss, engineers had of late been sharpening pencils to show the value of power savings through slight added initial costs in providing non-tuberculating lined pipes. Such savings had not been difficult to compute, even in cities enjoying the so-called non-aggressive waters.

Concerning the life of bituminous coatings, Mr. Thornhill cited 24 years of service of a hand brushed application 1/32-in. thick, as the longest American record. Spun enamel linings were more recent, their thickness being 3/32 inch and the enamel improved materially as to physical qualities, as the result of research and experience. It was Mr. Thornhill's belief that unlined pipes in important systems were eventually to be a rarity.

In reply to questions, Mr. Thornhill thought that probably the heavier coating on the oldest tar-dipped pipes accounted for their satisfactory history more than did any inherent change in quality of the tar itself. Porosity of coating could only be entirely overcome by adequate thickness and thus the superiority of coatings thicker than 1/32 inch.

"Water Shed Sanitation"—by DONALD C. CALDERWOOD, Engr. and Asst. Supt., Pennichuck Water Co., Nashua, N. H.

Mr. Calderwood outlined procedures followed in routine sanitary control of the 0.65 square mile area supplying the 2.75 m.g.d. average consumption of Nashua and environs. The company owned but 37 per cent of the water-shed area, but the nearest non-owned property to the reservoir shore line was 1,500 feet. A map had been prepared of all properties, showing the method of sewage disposal on each. Inspections of all such properties could be made frequently, and best on foot. Each inspector carried at all times a can of "H.T.H." (high test hypochlorite) for immediate use at any point of discovered hazard.

In reply to questions, Mr. Calderwood stated that either the state authorities or the water utility could demand sanitation improvements on a public water supply area. In Connecticut, W. J. Scott revealed that the law made it simple for the water utility to secure injunction against polluters. Asked to review the Bridgeport Hydraulic Development Co. case, Mr. Scott said that a property owner constructed a pond, defied the water utility to stop bathing therein. The owner was arrested by the company patrol officer; appealed the case, and lost; appealed to the state supreme court, which upheld the lower court; was only recently refused a review by the U. S. Supreme Court. The case, thereby, seemed permanently closed, indicating the rights of water utilities in respect to enforcing watershed sanitation, regardless of so-called riparian rights.

"The Removal of Iron and Hardness"—by DANIEL J. SAUNDERS, Manager, Industrial Sales, The Permutit Company, New York City.

Mr. Saunders discussed the undesirable effects from iron and manganese in public or industrial water supply; outlined the precipitation and zeolitic methods of removal. He pointed out the inhibitory effects of carbon dioxide in preventing complete oxidation of iron or manganese, and the necessity of eliminating it by aeration or neutralization with lime or caustic soda. Where organic matter is found in combination with iron, removal of iron by aeration and filtration alone had not been sufficient and the treatment had best be determined by experiments, involving use of a combination of chemicals. In the zeolite process of removing iron and manganese, complete removal could be assured only if the iron is in the ferrous state.

In discussing softening, Mr. Saunders reviewed the value and the limiting factors of the lime-soda and zeolitic processes and the modern practice of combining the two. He touched on the new carbon zeolite, capable of producing essentially distilled water from waters with carbonate hardness alone. He also referred to the Spaulding Precipitator. By its use 4 hours of conditioning and settling had been reduced to 1 hour, and costly recarbonation eliminated. The results were comparable to those of the lime-soda hot process. By lantern slides some of the more recent installations of softening plants were pictured—many being fully automatic zeolite plants serving the smaller communities.

Edw. H. Thwaits, Youngstown Sheet & Tube Co., Youngstown, Ohio
Sam'l G. Wylie, Supt., Water Dept., Webster, Mass.
Carter H. Lamb, Engr., Jamaica Water Co., Jamaica, L. I.

Horace L. Clark, Supt., Water District, Sanford, Me., related experiences with the Sanford zeolite plant for iron removal, in which 1.8 p.p.m. iron is reduced to between 0.1 and 0.2 parts and hardness to zero—this softened well water being mixed with spring water in ratio of 70 to 30. The most interesting feature of the plant was the low initial cost of $10,000 for the million gallon plant. Cost of treatment had been approximately $10.00 per million.

Chemists' Session

(Chairman—Edw. W. Moore, Harvard University)

The chemists staged a symposium on manufacture, specification, and handling of water-works chemicals.

"Lime"—by J. G. Thomson, Chief Chemist Lawrence Portland Cement Co., Thomaston, Maine.

Mr. Thomson presented the many details involved in production, grading, and processing limestone to meet specific requirements, in lime manufacture. He presented a resume of manufacturing steps from selection of the rock to its final loading in bulk or bags. The operation of kilns and hearths is described and valuable data on the hydration process and its control is given.

The hydrated lime, most largely employed in water treatment, may be so-called chemical lime or mason's lime. These are very similar forms, the former being slightly smaller in particle size as well as somewhat purer in composition. The agricultural grade is much coarser and less pure. Iron content of lime will vary with the quarry and with the particular strata from which it is obtained. To determine CaO content, the modified sugar test is the preferred method, and lime having above 90% CaO should be considered a premium grade.

"Copper Sulphate"—by E. Fitzpatrick, Chief Chemist, Nichols Copper Co., Laurel Hill, N. Y.

Mr. Fitzpatrick disclaimed knowledge of the application of copper salts in water treatment, but proved most capable in discussing their manufacture. All methods of manufacture have the solution of copper oxide in sulfuric acid as their basis.

Molten copper shot, of ¾ to 1-inch diameter, are dropped into water and resulting lumps (like pop-corn) are placed in the oxidizing tower. There they are sprayed intermittently with 20% sulfuric acid which forms a coating of copper oxide, and then dissolves it off with each new spraying. The solution is partially evaporated, run through a filter press and then to the crystallizing tanks. Copper rods are suspended in the solution for about 8 days to permit crystal formation, then are lifted by cranes and the attached crystals removed by rapping the rods. Further treatment includes centrifuging, passage through a warm-air tower, and screening. "Snow" grade of copper sulfate is prepared by grinding and heating the crystals to produce the mono-hydrate which may be used to make a concentrated solution.

In discussion of the paper, Mr. Fitzpatrick recommended the monograph by Dr. F. E. Hale (which his company distributes gratis) as presenting most useful data in regard to desirable dosage.

"Alum, Ferrisul, Sodium Aluminate"—by F. A. Abbiati, Ass't. Sales Manager, Merrimac Div. of Monsanto Chemical Co., Boston, Mass.

Noting that some 370 thousand tons of aluminum sulfate are produced yearly in this country and that some 60% of this is employed in water treatment, Mr. Abbiati called attention to the fact that other coagulants such as "Ferrisul" and sodium aluminate are gradually being adopted as important water coagulants. The early use and preparation of natural (potash) alum, now little used in the United States, was described. Present production of aluminum alum from bauxite (obtained in Georgia and Arkansas) requires 500 thousand tons of ore annually, and it may become necessary, at this rate of consumption, to employ grades of ore having lower aluminum content. A continuous process of digestion with sulfuric acid, coagulation with glue, clarification, cooling, grinding and classification is employed in modern manufacture.

Sodium aluminate, produced for many years before its use in water treatment, is also made from bauxite. The ore is autoclaved together with caustic soda, then washed, settled, and filtered. Aluminum hydrate is precipitated and some liquid caustic soda is recovered in the process.

For production of "Ferrisul" (ferric sulfate) the raw material is pyrite cinder which results from the manufacture of sulfuric acid. The ground cinder is digested with sulfuric acid in heated tanks, the liquor settled, then concentrated. Finally crystals are formed on added particles of anhydrous ferric sulfate. The crystals, which have seven molecules of water, are dried at high temperature and granulated.

The special technique required to dissolve "Ferrisul" was described in detail by Mr. Abbiati as requiring a temperature of 125° F. (which may be produced by the proper ratio of water and chemical) and agitation for 30 minutes in a dissolving tank.

In discussing the use of these chemicals, Mr. Abbiati stressed the ability of iron coagulants to form a stable floc over a wide pH range.

"Activated Carbon"—by E. A. Sigworth, Industrial Chemical Sales Div., West Virginia Pulp and Paper Co., New York, N. Y.

Like the preceding papers in this symposium, the competent discussion of principles involved in manufacture of materials presented information of basic interest to chemists. In some detail, Mr. Sigworth dwelt upon points such as the selection of materials, charring, burning off of impurities, control in manufacture, and grinding.

As a comprehensive source of data concerning carbon specifications, he recommended the report of the A. W. W. A. committee which was published in the Journal of the association in July, 1938. The moisture content of carbon is important (if above 8%) because it results in poor operation of dry feed machines rather than inefficiency of the carbon. Taste and odor removal, as well as feeding, depends to a degree on fineness of the carbon.

Considerable discussion was devoted to the phenol value and, more particularly to the threshold odor tests for evaluation of carbon efficiency and economy. The technique of the threshold odor test, most desirable for comparing the effectiveness of various types of carbons in treatment of specific water supplies, was the basis of a considerable part of the paper. Recommended procedure and "short-cuts" in making the test, the necessary equipment, and individual sensitivity, were points upon which Mr. Sigworth proved well informed.

BIO-FLOCCULATION AT THE NEW BRUNSWICK, N. J., SEWAGE TREATMENT PLANT*

Results of An Experimental Run, Compared With Plain Settling and Chemical Precipitation

By HARRY W. GEHM[1]
Rutgers University,
New Brunswick, N. J.

The Author

ALL modern chemical treatment plants are equipped with flocculating equipment of some sort. The types common to this country fall into two classes, namely, paddles and diffused air. These devices are installed primarily to effect floc formation when chemical coagulants are applied. Recently, interest has been directed to bio-flocculation as a means of increasing the removal of suspended solids from raw or settled sewage on settling subsequent to relatively short detention periods. No attempt is made here to review the history and development of this process as such has already been adequately done by Dr. Heuekelekian in the Proceedings of the Penna. Sewage Works Association, 1937.

The purpose of this paper is to present data obtained at the New Brunswick, N. J., chemical treatment plan when operated as a bio-flocculation unit. The main equipment involved in bio-flocculation operation consisted of two paddle type flocculators 40 ft. long, 17 ft. wide and 10 ft. flow-line depth. Each contains 3 paddles 8 ft. in diameter. Four paddle speeds were provided for by control. It was originally intended to study the effect of paddle velocity but it was soon found that the lower speeds of flocculation allowed considerable settling in the flocculators when raw sewage was passed through. Thus all work was done with a peripheral velocity of 1.8 ft. per second.

Operations

Conditions at New Brunswick at the start of operations were particularly advantageous for study of the effect of time of flocculation on clarification. Collecting sewers were connected to the interceptor one at a time, giving flows of from 1.3 to 9 million gallons a day through the plant. The changes in flow provided variations in time of flocculation from 20 minutes to 4.5 hours. The fact that one or both flocculators could be used gave added flexibility.

In experiments made on the effect of time of flocculation samples of raw sewage and flocculator effluent were taken in Imhoff cones, allowance being made for flowing through time. Samples were allowed to settle two hours and turbidity and suspended solids were run on the supernatants. This was necessary in order to obtain comparable settling time throughout the study. Runs were eight hours in length and the sampling intervals were determined by the detention time in the flocculator.

*Journal Series Paper, N. J. Agricultural Experiment Station, New Brunswick, N. J. Division Water and Sewage Research.
[1]Assistant, Division Water and Sewage Research.

The Sewage Treatment Works of New Brunswick, N. J.—Provides Seasonal Chemical Treatment.

Twin Turbo-Mixers, Flocculators and Clarifiers at the New Brunswick Plant.

When complete flow was received runs were made with 30 minute flocculation and 30 minute sampling period, using the clarifiers for settling. The settling time under these conditions was 4 hours. Half of the flow was passed directly through the clarifier while the other half passed through the flocculators and clarifier. This arrangement made possible a direct plant comparison of plain settling and short period bio-flocculation. The periods of flocculation chosen for the runs made were 4.5 hours, 3 hours, 1.5 hours, 45 minutes and 20 minutes.

Results

The percentage removals of suspended solids for the above periods are shown in Figure No. 1.

The removals of suspended solids observed were substantiated by the turbidity removals. Figures showing turbidity removed by different periods of flocculation are plotted in Figure No. 2.

The B.O.D. figures showed wide variation due to the intermittent presence of toxic industrial wastes in the sewage. This was shown by the fact that the higher the dilution used, the higher the B.O.D. figure at times. However, figures obtained from samples not containing trade waste showed that B.O.D. reductions were 5 to 30 per cent above those from plain sedimentation, the extent depending upon the time of flocculation and original strength of the sewage.

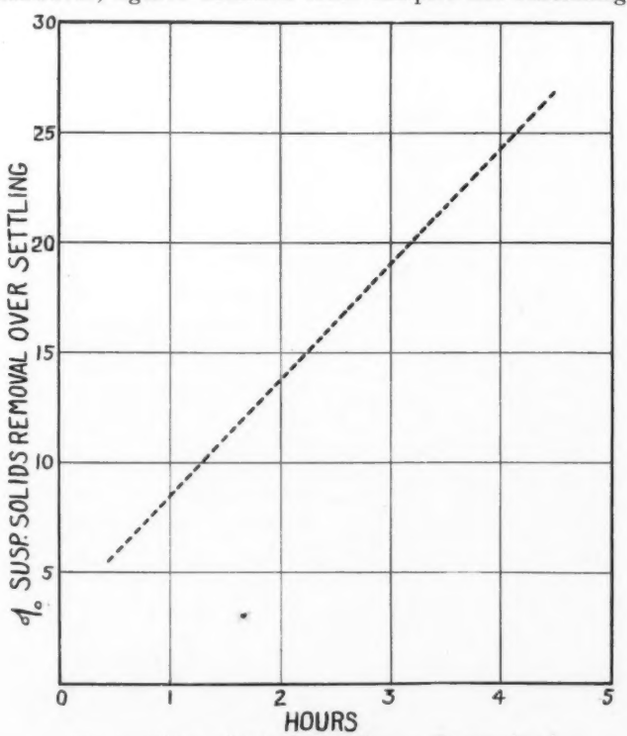


Fig. 1. Effect of Bio-flocculation on Removals of Additional Suspended Solids.

Experiments conducted with clarifier settling and 30 minutes flocculation time yielded results which correspond closely in results obtained for short periods of flocculation followed by settling in cones. Results given in Table No. 1 are typical of suspended solids removal.

TABLE No. 1

TOTAL SUSPENDED SOLIDS — NEW BRUNSWICK PLANT — CLARIFIER SETTLING

	Raw	Settled	Floc and Set
	208	40	42
	126	64	46
	124	42	56
	134	56	44
	128	56	40
	156	40	22
	152	54	38
	174	44	38
	212	54	54
	124	62	38
Mean	154	51	42

Effect of Trade Wastes

When certain industrial wastes were present, such as acid waste, it was observed that an excellent floc formed in the flocculator but not in the sewage that was not paddled. Results of a typical example of the greater removals obtained under these conditions are demonstrated in Table No. 2. These results were obtained when the pH of the sewage was around 4.0. Detention time in flocculator was 45 minutes and samples were 15 minute composites taken for 3 hours.

For purposes of comparison it was thought well to include here figures from a typical run when chemicals were employed. These used were chlorinated copperas and lime. The average dosage of the coagulant applied over the eight hour period presented in Table No. 3 represented 48 lbs. of iron per million gallons and 256 lbs. of lime as CaO. Samples were taken every 15 minutes and composited for each hour.

TABLE No. 2

REMOVAL OF SUSPENDED SOLIDS AND TURBIDITY BY FLOCCULATION AND SETTLING WHEN ACID WASTE WAS PRESENT

Total Suspended Solids, p.p.m.			Turbidity, p.p.m.	
Raw Sewage	Plain Settled Effluent	Floc and Settled Effluent	Plain Settled Effluent	Floc and Settled Effluent
138	118	22	156	56
153	72	12	104	26
129	44	18	104	10

Discussion

Examination of the curves dealing with time of flocculation shows that the removal is in almost direct proportion to the time of flocculation. These results differ somewhat from those of an earlier laboratory study, in which many different samples from various plants were treated. The average results obtained there showed the greatest removal occurring during the first ½ hour of flocculation, with little improvement beyond. This difference is due to the character of the weak New Brunswick sewage, which contains no great amount of pseudo-colloidal matter which readily flocs out, rather than to a difference between laboratory and plant scale

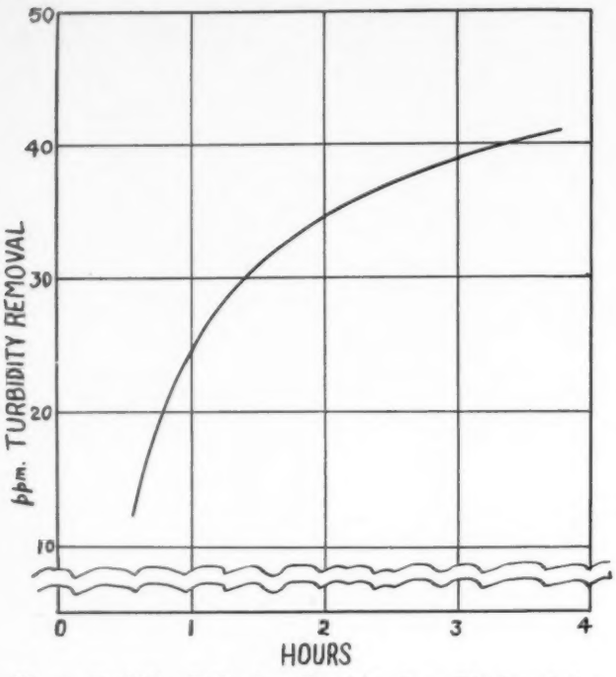


Fig. 2. Turbidity Reductions Resulting from Bio-flocculation.

results. This explanation is substantiated by the lower removals for short periods of flocculation than were found in the former study.

When 4 hours clarifier settling was used with short periods of flocculation the same amounts were removed as when outside settling was employed. The long period of settling probably accounted for this close correlation.

B.O.D. results indicated that, as previously observed, the removal of solids by this process was accompanied by a corresponding reduction in B.O.D.

The high removals obtained by flocculation when acid trade waste was present are readily understood. The situation amounted to acid chemical treatment and the justification for flocculation was brought out clearly as applying to this type of chemical treatment as to any other.

Results of the short runs employing chlorinated copperas and lime showed that no difficulty was encountered in obtaining good clarification of the varying mixture of sewage and industrial waste treated at New Brunswick, N. J. The chemical dosages employed fell within reasonable economic limits. Addition of chemicals gave better results than did 4½ hours of bio-flocculation.

TABLE No. 3

RESULTS OBTAINED BY A TYPICAL TEST RUN USING CHEMICALS

Time	Plain Settled	Chemically Treated and Settled
8 to 9	108	25
9 to 10	96	22
10 to 11	94	32
11 to 12	108	16
12 to 1	99	10
1 to 2	74	22
2 to 3	68	17
3 to 4	82	21
Mean	91	21
% Removal	48	89

Note: Raw Sewage averaged 174 p.p.m. Total Suspended Solids.

Conclusions

1. Bio-flocculation of New Brunswick sewage for short periods yielded a consistently better effluent than did plain settling.

2. Long periods of paddling gave large reductions in suspended solids and B.O.D. as high as 80 per cent and 70 per cent respectively.

3. Flocculation was aided and removals were amplified when acid wastes were present, producing an effluent with only 12 to 22 p.p.m. suspended solids.

4. Chemical treatment with chlorinated copperas and lime gave results, on the basis of suspended solids removal, superior to 4½ hours of bio-flocculation alone.

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INDIANA SECTION FINDS DISTRICT MEETINGS HIGHLY SUCCESSFUL

From Paul C. Laux, Chairman of the Indiana Section of A.W.W.A., has come the accompanying picture of a group attending one of Indiana's District Water Operators' Meetings. Such interim meetings are sponsored jointly by the Indiana Section of A.W.W.A., the State Dept. of Health, and Purdue University.

These one day district (grass-roots) meetings staged in various parts of the State, have been held during the past four years with considerable success. The scheme constituted an attempt to reach, and help, operators from the smaller towns of Indiana by "bringing the meetings to the operator"—so to speak. The programs have been especially planned for those men who get to few if any others.

▼

W. A. CHAPMAN HEADS ROBERT W. HUNT LABORATORIES

Mr. Wilder A. Chapman has been appointed Manager of Laboratories for Robert W. Hunt Co., Engineers,* with headquarters at Chicago.

Mr. Chapman is a graduate of Tufts College with a B.S. in Chemistry and is a member of the following Societies: American Society for Metals; American Chemical Society, the Technical Association of the Pulp and Paper Industry and of the Standards Committee of this Association.

Following an earlier association with the Solvay Process Co., Mr. Chapman was connected with the D., L. & W. Ry., for over six years. He joined Skinner and Sherman Incorporated, of Boston, in 1924 and has been Secretary, Director and Clerk of that Corporation since 1930.

*This long established firm of engineers is this year celebrating its Golden Anniversary.—Ed.

The Editor's Comments

IT STANDS ON ITS OWN

"LOCAL Water Utility Doing a Good Job"—Was a headline in a recent Sunday edition of Akron's *Beacon Journal.*

Beneath this commendatory headline appeared a full column telling of the accomplishments of the Water Department of Akron, Ohio. Then, here is what the sub-heading stated—"Deprived of Important Income that Other Cities Get, We Still Show a Profit."

Note that *"WE"* stuff. Here's the point: The article was prepared by a friendly staff writer of a friendly paper. The Water Department had made an excellent showing as revealed by financial records, concerning which there could be no speculation. The local manager had shown the staff-writer, if not the editor also, to what extent physical betterments had been made to strengthen the system in recent years on a pay-as-you-go basis; what revenues the Water Department should have had in return for fire protection, but hadn't realized. Even so, how the water rates had been held down and a small profit realized, reflecting good management.

So the local manager having something to sell, and having sold it to the local newspaper, the pride denoting "WE" was the result. No telling what degree of psychological influence that little "WE" has had on Mr. and Mrs. John Q. Public of Akron. It assuredly instilled the pride over having a Water Department which rated the sort of story that was written, plus the commendatory reporting of what Akron citizens can boast. Along this same line, if you ever hear the Chamber of Commerce or the Rotarians, or the man on the street, refer to *Our* Water Department (or Company) instead of *The* Water Department, then you may be pretty sure that the local water utility management is of the right sort.

The Akron newspaper clipping above referred to was sent to us by a friend who "thought we might be interested." That we were *genuinely* interested the space given on this page constitutes sufficient evidence. That we were expected to be interested probably is the result of this friend having heard us repeatedly advocate the policy that water works superintendents and managers should seek publicity of the right sort through the local press, and not wait for publicity of the damaging sort to have full play. Further, that these men, of such worth to their community, look beyond that personal satisfaction of a job well done. That they turn on some of the light for their own good, which in turn will be reflected throughout the organization they head. Get the local newspapers telling the public about *"Our"* water utility and what *"We"* have done, and it's not difficult to predict the result.

Now let's look into Akron's record in part and the accomplishments of the superintendent and chief engineer of Akron's Water Department, W. R. LaDue, which the *Beacon Journal* has been able to pass on to Mr. and Mrs. John Q. Public. They were told that although *their* water works was carrying the highest bonded debt, it could boast the lowest operating cost of any in the state. That, the taxpayer of Akron was receiving a hidden reduction in his tax bill, but in exchange was being deprived of a lower water rate. This, because the Water Department had been paid nothing for the fire protection service rendered these many years since the city purchased the system from a private company to which monthly rentals on every fire hydrant had previously been paid. That, Water Departments of less well off cities were receiving such supporting income in the form of hydrant rents, which would in Akron's case amount to sufficient from the 5,328 hydrants maintained (as a free service) to pay 90 per cent of the $350,000 annual operating expense of the Water Department. Then, too, schools and hospitals were being supplied water free which had cost the Water Department $500,000 in 10 years, again depriving consumers of rate reductions, but keeping tax rates down. What the whole thing amounts to, stated the article, was that the Water Deparment was deprived of an average of $6.00 income per consumer, per year, which could otherwise be lopped off of Mr. and Mrs. John Q. Public's water bill.

The article did not leave Akronites wondering why the high bonded debt on their water system. It listed the betterments added to keep pace with the rapid industrial growth of Akron, which had raised the value of the $900,000 system (when bought) to one of $17,000,000—now boasting a 20,000,000 gallon covered service reservoir, a supply lake of 2,500,000,000 gallons, 631 miles of pipe (only 105 miles when purchased), 55,000 service connections, 56,400 meters (3,690 when purchased) a 25 M.G.D. filtration plant.

Despite its free services, the Akron Water Department last year retired $904,700 of bonded debt, paid out $435,000 for operation and maintenance, had $5,300 left as profit. This, we contend, constitutes a good record for any business that isn't getting all that's coming to it.

The Akron record is indeed an enviable one—one hard to beat, if beatable. To manager La Due we take off our hats; to the *Beacon Journal* our high compliments on the splendid job of selling the Akron Water Department and its management to Akronites. We hope other friends can send us as valuable clippings from other quarters.

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AND—ANOTHER CASE

RATING 19 inches of 2¾ inch column on the editorial page of a leading newspaper, such as *The Birmingham News,* is not a commonplace experience of engineers. However, such has recently been the experience of Harry H. Hendon, a young sanitary engineer, who only a short time ago recognized for his accomplishments as engineer and manager of the sewerage works of Birmingham, Alabama, was picked for the position of Chief Engineer of Jefferson County.

The *News* had much of a laudatory nature to say concerning "Jefferson County's able Chief Engineer" and the soundness of his plans, designed to save the county $125,000 annually. While details of the program are unimportant for the moment, the editorial proceeded to show what an analytical and inventive engineering mind can accomplish, in bettering conditions and advancing economies, when politics go out and ability is given an opportunity. But, for managers and engineers to receive the recognition due them someone must do a bit of flag-waving in their behalf. How better can this be attained than through the "Birmingham Newses" and the "Beacon Journals" at our disposal if we have the "stuff"?

EQUIPMENT NEWS

Pittsburgh Equitable Meter Offers Raybould Couplings

The Pittsburgh Equitable Meter Co. has been appointed sole distributor for Raybould Couplings and Fittings, manufactured by the Raybould Coupling Company of Meadville, Pa. Grover E. Seaberg, Manager of the Coupling and Fitting Division, will direct sales for Pittsburgh Equitable.

The Raybould Coupling (patented) consists of two resilient compression rings, metal bushed at either end and encased in two flanges or follower rings which bear against a center ring, acting as a spacer between the flanges. In sizes smaller than 3 in. the flanges consist of two compression nuts, and the coupling is fastened by tightening these nuts on the threaded center ring. Larger sizes employ long track head bolts and nuts to draw up the two flanges.

To permit the metal bushing to close tightly around the outer wall of the pipe, a clearance slot constitutes a feature of the design. This slot not only takes up the allowed clearance, over maximum pipe diameter, but also compensates for maximum and minimum tolerances in all pipe diameters.

Distinctive features claimed for Raybould Couplings include: (1) Design provides greatly increased coupling grip on the pipe; (2) Contents of pipe cannot make contact with or deteriorate the compression ring; (3) Small diameter or out-of-round pipe does not affect the coupling joint; (4) Requires a minimum number of bolts.

For more complete information and bulletin describing "Raybould Couplings," write Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.

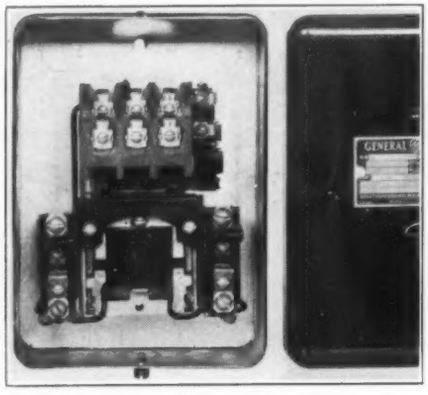
Raybould Couplings (Screwed and Bolted Type)

New "G.E." Switch More Compact

A new magnetic switch has been developed by General Electric for full-voltage starting of single-, two-, and three-phase motors. While it is small and compact, it has been designed in full accordance with established standards of electrical clearances, mechanical strength, and ratings.

Basically, the switch consists of a line contactor, with interlock to provide under-voltage protection; and two isothermic temperature overload relays, to protect the motor against over-heating. The contactor is the direct-acting, solenoid-operated type and is entirely self-contained. The cold-molded barrier head, on which the stationary contacts are mounted, is impregnated with a special wax to make it nonhygroscopic.

The E-type magnet employed is a new design. It makes use of an improved rivet-type pope-shader on two legs of the magnet, with the air gap necessary to assure dropout when the coil is de-energized, permanently built into the third leg. The magnet seals on all three legs instead of the conventional two legs, thus distributing the hammer-blow (on closing) over the entire sealing surface and materially increasing the life of the magnet. The operating coil is layer-wound, each layer being insulated by a layer of kraft paper, and is specially treated under pressure with a heavy Glyptal varnish.



New G. E. Magnetic Switch

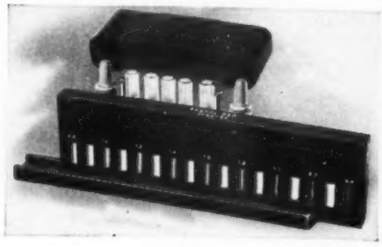
The contacts are double break, to eliminate troublesome flexible shunts, and both stationary and movable tips are made of fine silver, with a thin steel backing for mechanical strength and durability. The improved switch also includes a new-type isothermic temperature overload relay which, despite its small size, contains all the desirable features included in relays of earlier design. Permanently adjusted at the factory, this switch is tamperproof and can be easily set for either hand-reset or automatic-reset.

For further details, write General Electric Co., Schenectady, N. Y.

Improved Slide Comparator

A new Slide Comparator for the colorimetric determination of pH, chlorine, etc., has been developed by W. A. Taylor & Co. of Baltimore, Md.

The new comparator is molded entirely from plastic, and radical changes in design have resulted in marked improvement in appearance, durability and ease of handling. The weight has also been considerably reduced. All pH, chlorine and phosphate values, as well as the indicator names, are engraved in white directly on the plastic slides. Improved catches are used to hold the top on the base, and all metal parts are *rustproof*. The whole outfit, including the slide, is 10 in. long, 2⅛ in. wide and 4 in. high. It weighs only 1½ lbs.



New Taylor Slide Comparator

Each comparator slide contains 9 color standards, alternating with ampoules of distilled water, and all standards are guaranteed to remain accurate for a period of 5 years. The base contains vials of indicator solution, pipettes, test tubes, and a piece of etched glass in a special compartment. One base can be used with any number of color standard slides. For descriptive literature presenting more in detail, concerning design and manipulation, write W. A. Taylor & Co., 872 Linden Ave., Baltimore, Md.

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Paints for Wet Surfaces

The Wet-X-Hale Paint Co. of New York City produces a line of paints which are guaranteed to adhere to wet as well as dry surfaces and provide equal protection, something of particular interest in the water and sewage fields.

The feature of Wet-X-Hale paints and varnishes are the materials blended in by the manufacturer to absorb moisture during paint application. Being lighter than the paint the resultant hydrated compounds appear on the paint surface and evaporate. Upon drying (or setting) the W.X.H. paint film becomes impervious to moisture and no blistering is experienced. These interesting paints are offered for wood, concrete or metal surfaces.

For descriptive literature, write the Wet-X-Hale Paint Compound Co., 16 Moore St., New York City.

"Armor-Clad" Pipe Protection

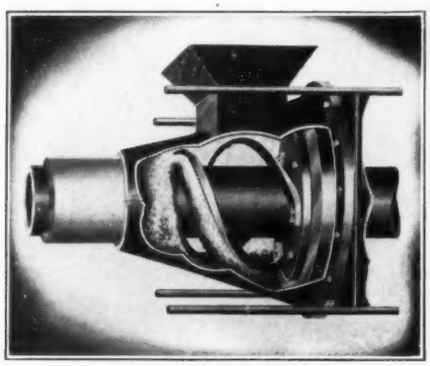
The American process of protecting pipes by "Armor-Cladding," with a dense coating of cement or bituminous concrete, has recently been announced by the American Pipe & Steel Corp. of Los Angeles. The new method involves application of the plastic mortar with the unique machine illustrated below.

"Armor-Cladding" is based on the theory that any properly prepared material can be made to adhere tightly to pipe if it is submitted to continuous trowelling or rubbing pressure. However, such plastic materials must be of the proper consistency, similar to that produced with bituminous and concrete "Armor-Clad" formulas, to respond to the spiral rubbing, trowelling, and tamping action that is the secret of the process.

One of the important considerations in "Armor-Cladding" is that pipe lines can be coated *in the trench* without interruption of service in any way. The light (steel) construction of the machine facilitates its handling under a variety of conditions. It is adjustable to various sizes of pipe and can apply coatings of thicknesses ranging from 5/8 inches to 2 inches. Easy removal of parts makes for ease in passing obstructions and joints.

In one case, report the manufacturers, a pipe that had 20% of its area completely rusted away was rehabilitated and made serviceable; its newly acquired mechanical strength supplied by the applied concrete enabled it to successfully withstand pressures as high as 90 pounds.

For a catalog presenting further details concerning "Armor-Cladding," write American Pipe & Steel Co., Los Angeles, Calif.



New Pipe Armoring Machine

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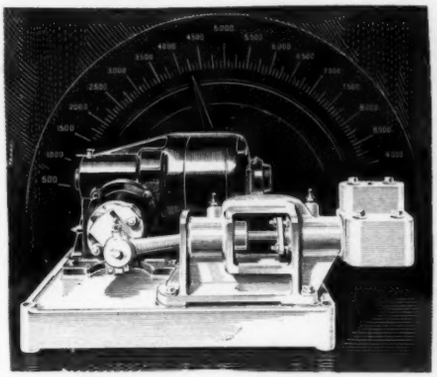
Milton Roy Proportioning Pumps

Although not new in the industrial fields, Milton Roy Chemical Pumps and Proportioners will be new to most of the readers of this magazine.

A new bulletin, just received, describes and illustrates the improved models of Milton Roy chemical feed pumps, designed to inject any chemical solution against pressures from 0 to 15,000 pounds. From the list of users we understand that these units have given satisfaction in adding chemicals against boiler pressures, and in various manufacturing operations.

In the specifications set forth, an exclusive feature emphasized is the "self-cleansing" double-ball check valve on both the suction and discharge sides of the displacement plunger. The pump discharge rate is varied by changing the length of piston stroke. Units are with capacities running from less than 1 gallon to 212 gallons per hour.



Milton Roy Chemical Pump

For bulletin No. 938, write Milton Roy, 2031 E. Madison St., Philadelphia, Pa.

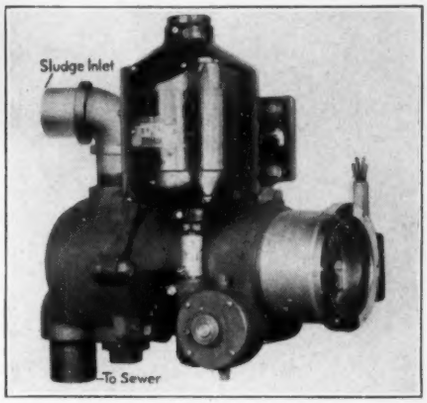
▼

Automatic Desludging

The Permutit Company has placed on the market a new Automatic Desludging Valve. It functions to automatically transfer sludges from one tank to another, to pump sumps, or to waste.

This motor operated valve is simple and rugged. It may be operated from a program clock, so as to open at selected intervals and remain open for set periods of time. It may also be operated from a float, or other device making electrical contact so as to open the valve whenever the sludge level reaches or exceeds the desired depth in a tank or sump. Although designed especially to eliminate hand operations (and human element) in water softening plant control, it probably will find other uses in the water works and sewerage fields.

For a copy of the "Automatic Desludging Valve" bulletin, address The Permutit Co., 330 W. 42nd St., New York City.



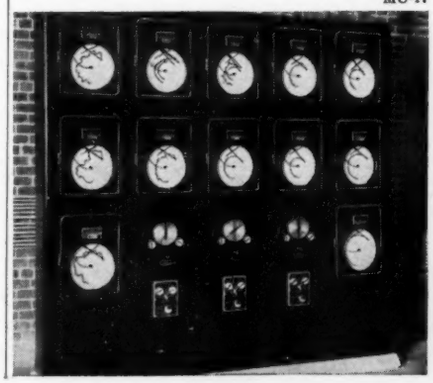
New Automatic Desludging Valve

THE *Bailey Synchro-Meter* GIVES YOU *Flexibility* IN METERING APPLICATIONS

● This meter panel includes both direct mechanically operated Fluid Meters and Bailey Synchro-Meters, which are electrically operated by remote transmitters.

Wherever you have need for a central meter panel incorporating both mechanically and electrically operated Fluid Meters, it is possible to maintain uniformity and neatness by employing this system of transmitting meter and recorder readings.

MU-17



Readings of flow, pressure, temperature, liquid level and other factors are accurately and quickly transmitted from out-of-the-way places to the receiving indicator, recorder or integrator by the Bailey Synchro-Meter.

This electrical mechanism which is completely described and illustrated in Bulletin No. 194-A, can also be used to eliminate the necessity of running high pressure piping up to meter and control panels.

Write for your copy of this new Bulletin.

BAILEY METER • COMPANY •

1072 Ivanhoe Road, Cleveland, Ohio

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MEETINGS SCHEDULED:

Nov. 16-19—ATLANTA, GA. (Georgia Tech.)

Georgia Water and Sewage Operators' Assn. and Short School. Sec'y-Treas., Paul Weir, Supt., Filtration, Atlanta, Ga.

Dec. 7—BANGOR, MAINE

Maine Water Utilities Association. Sec'y, Earle A. Tarr, Winthrop, Maine.

Dec. 29—NEW YORK CITY, N. Y. (Pennsylvania Hotel)

New York Section A. W. W. A. ("Get-Together" Luncheon Meeting, 12:30 P. M.) Sec'y, R. K. Blanchard, 50 West 50th St., New York City.

Jan. 18-20, 1939—NEW YORK CITY, N. Y. (Eng. Soc. Bldg.)

American Society Civil Engineers. Sec'y, Geo. T. Seabury, 33 West 39th St., New York City.
(Jan. 19—Sessions and Joint Annual Dinner of the Sanitary Engineering Division.)

Jan. 19-21—NEW YORK CITY, N. Y. (Hotel McAlpin)

New York State Sewage Works Ass'n. Sec'y, A. S. Bedell, State Board of Health, Albany, N. Y.
(Jan. 19—Joint Annual Dinner with Sanitary Engineering Division.)
(Jan. 21—Joint inspection trip with San. Eng. Div. of A. S. C. E.)

March 9-10—TRENTON, N. J. (Stacy-Trent)

New Jersey Sewage Works Association. (24th Annual Meeting.) Sec'y, John R. Downes, Bound Brook, N. J.

April 10-12—MEMPHIS, TENN.

Kentucky-Tennessee Section A. W. W. A. (Tentative) Sec'y-Treas., H. D. Schmidt, State Dep't Health, Nashville, Tenn.

April 12-14—TORONTO, ONT. (Royal York Hotel)

Canadian Section A. W. W. A. Sec'y-Treas., A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

April 27-28—DAYTON, OHIO

Ohio Section A. W. W. A. (Tentative) Sec'y-Treas., T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

June 11-15—ATLANTIC CITY, N. J. (Hotels Ambassador and Chelsea*)

American Water Works Association. (59th Annual Convention.) Sec'y, Harry E. Jordan, 22 East 40th St., New York City.

*Exhibits to be set up in Atlantic City Auditorium.

CATALOGS AND LITERATURE RECEIVED

[*Any of the publications reviewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.*]

"A New Principle in Rust Prevention"—Is described in a brochure from Feroleum Products Inc., of New York. Under the trade name "Feroleum" this unique protective coating is described as a *non-oxidizing* vehicle carrying the desired paint pigment. Explaining that oxidation, in hardening and subsequently, is the destructive effect which causes ordinary protective coatings to "chalk" and deteriorate or break down, the dominating feature of Feroleum involves the principle of hardening by molecular change (polymerization) in which oxidation plays no part whatever. The "stable" film thus produced remains permanently live, tough and elastic. Another feature is the ability of Feroleum to penetrate rust and beneath it bond with the metal proper. Therefore, expensive chipping and wire brushing of corroded surfaces, preparatory to painting, is said not

to be necessary in the application of Feroleum, which actually is in itself a corrosion inhibitor. Further, it has less than one-fourth the water absorption capacity that is observed in the case of oxidized coatings, and is claimed to be thoroughly resistant to salt spray, alkalies and acids. A list of proper Feroleum coatings for various purposes and surfaces, around water works and sewage treatment plants, accompanies the brochure. For a copy of the brochure and color chart, write Feroleum Products, Inc., 11 West 42nd St., New York City.

"The ACCELATOR"—Is the subject of an International Filter Company bulletin, fresh from the press. The "Accelator" (which interpreted means an accelerating device) is a tank in which water softening reactions are more speedily brought to completion, to produce a higher degree of clarification and less residual hardness, than is attained through conventional softening processes. The principle involves a floating sludge blanket, upwards through which the water undergoing softening must pass. The softening chemicals are applied *to the sludge,* rather than to the raw water which enters the "Accelator" at a point 180 degrees removed from the chemical feed. The result is a combination effect of split-treatment and sludge recirculation. The graphic comparison of the reduced size of an "Accelator" equipped plant, as against the conventional municipal softening plant requiring separate mixing chambers and about 8 times the reaction and settling area, is impressive. The advantages listed for the "Accelator" cover fourteen items, including several "which have brought new economic significance to water softening." Typical installations are pictured. For a copy of Bulletin 1820 write International Filter Co., 59 E. Van Buren St., Chicago, Ill.

"Columbia Alkali's Tabloid Catalog" — Just received is a novel, interesting and informative pocket size booklet put out by Columbia Alkali Corporation of Barberton, Ohio. This handy little catalog describes the complete line of Columbia products, amongst which are Liquid Chlorine, Caustic Soda, Sodium Bicarbonate. A convenient and novel from of visible "flash" indexing constitutes a unique feature of the production. Each product is described, and the styles of packaging and forms in which available are given—also the more important applications are cited for a number. The booklet thus serves a useful purpose as a purchasing guide. Under "Chlorine," its expanding use in the water works and sewage fields is noted. And, emphasized is the fact that the dead (tare) weight of Columbia's chlorine cylinders of modern design is appreciably less than those commonly employed. An impressive picture of Columbia's Barberton Works, a listing of branch offices, and the first appearance of a most attractive new trade-mark completes the unique "Tabloid Catalog" of a rapidly advancing corporation. For a copy, write Columbia Alkali Corporation, Barberton, Ohio.

"Klemp Gratings"—Are described in an illustrated folder from Wm. F. Klemp Co. of Chicago. In addition to the well known Klemp Diamond Grating and Stair Treads, the "Klemco" Rectangular Grating is presented pictorially and effectively. The technical data, which includes U. S. Government Specifications showing minimum requirements for various loadings on gratings, should prove of particular interest to designing engineers. Types of anchors and methods of anchoring gratings are illustrated. Emphasis is placed on the design of Klemp Stairtreads for nose strength and better nose visibility, to preclude tripping or step missing. Emphasis

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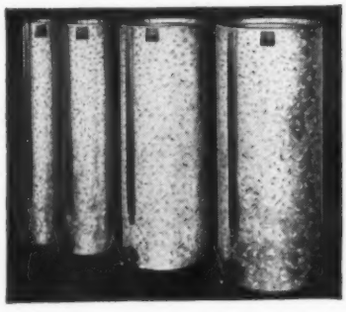

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is also placed on the policy of the manufacturer to fabricate gratings from engineers' drawings, in order to insure accurate fit and neatness. Some typical sewage plant installations, of galvanized and aluminum grating, illustrate the result. For the "Diamond" and "Rectangular" gratings bulletins, write Wm. F. Klemp Co., 6624 South Melvina Ave., Chicago, Ill.

"SPARLING — Main Line Meters" — Are described in a new and complete catalog issued by R. W. Sparling of Los Angeles. Various types of Sparling's low head-loss (propeller) meters, and their adaptation, are effectively illustrated, as are Sparling indicating and recording instruments. Emphasized is the guarantee of accuracy within two per cent, low loss-of-head, compactness, ease of installation. A full list of tabulated specifications, covering meters and instruments (along with prices) appears on the final two pages. Sparling's meter "exchange service" is described as a policy feature. The newest meter described seems to be the Sparling Compound, which operates on the principle of other compound meters, but is comprised of two Sparling Main Line Meters. In operation the flow "slides" over from the small bypass meter to the full pipe size meter, thus avoiding the sharp change-over of most compound meters. The pressure loss is far less too—stated to be but 2 lbs. at full capacity flow. For further details, write for Bulletin 305; address R. W. Sparling, 945 N. Main St., Los Angeles, or 101 Park Ave., New York City.

"Taste and Odor Control—5th Anniversary Number"—Which has just been issued by the manufacturers of "Nuchar" activated carbon, features a condensed review of the "History and Development of Activated Carbon in Water Treatment"—by John R. Baylis. To those who have followed the romance of activated carbon in water purification, and its speedy acceptance as a material of remarkable attributes (as a "friend in need—a friend in deed"), the 5th Anniversary Number of *"Taste and Odor Control"* will prove especially interesting. To all it gives a concise picture of the interesting history and present status of carbon in water purification. For a copy write Industrial Chemical Sales Div., W. Va. Pulp and Paper Co., 230 Park Ave., New York City.

"The American Mono-Tractor"—Comes as an illustrated brochure from American Monorail Company of Cleveland, Ohio. The "Mono Tractor" constitutes a compact electric drive unit which operates on an entirely new principle for the handling of one-ton chlorine containers, barrels of chemicals, etc. It travels on the well known American Monorail overhead track system. The "Mono-Tractor" is also used now to drive heavy or light duty overhead cranes. The bulletin also describes American Monorail Scales. For a copy of the "American Mono Tractor" write American Monorail Co., 13107 Athens Ave., Cleveland, Ohio.

"Automatic Controls"—Is a new catalog from Automatic Switch Co. of St. Paul, Minn., which covers the entire line of automatic and remote control equipment for water systems and sewage disposal plants; pump stations in particular. A listing of new prices also appears. The line includes—"Tanktrols" for elevated tank and reservoir systems; "Selectrols" for program or selective control of sewage or sludge pumps; "Floatrols" for sequence operation of water or sewage pumps; "Duotrols" for automatic water and air control in pneumatic pressure tanks systems; "Float-Switches" for all types of pumps. The new catalog represents the first in

which all automatic control devices offered by the manufacturer have been covered under a single cover. For a copy of Catalog C-2 write Automatic Control Co., 2590 University Ave., St. Paul, Minn.

"Goulds Pumps"—A new line of Gould's centrifugal pumps are announced in a bulletin which describes Fig. 3390 Gould Centrifugal Pumps. These new pumps are two-stage units with hydraulically balanced (opposed) impellers, and are designed for heads up to 1,000 feet. The bulletin gives complete illustrated description of the Fig. 3390 pumps. Address Gould's Pumps, Inc., Seneca Falls, New York.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Water Works and Sewerage, published Monthly at Chicago, Ill., for October 1, 1938.

State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. S. Gillette, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Water Works and Sewerage and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Gillette Publishing Company, 330 South Wells St., Chicago, Illinois.

Editor—L. H. Enslow, 155 E. 44th St., New York, N. Y.

Managing Editor—John Cecil Black, 330 South Wells St., Chicago, Illinois.

Business Manager—E. S. Gillette, 330 South Wells St., Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its names and address, as well as those of each individual member, must be given.)

Gillette Publishing Company, 330 South Wells St., Chicago, Illinois.

H. P. Gillete, 330 South Wells St., Chicago, Illinois.

Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.

Mrs. R. W. Hume, 303 So. Stone Ave., La Grange, Ill.

Provident Trust Company, 17th & Chestnut Sts., Philadelphia, Pa.

Louise Forsythe, 13 E. Windermere Terr., Lansdowne, Pa.

La Verne Louer Hellyer, Ambassador Hotel, Chicago, Illinois.

L. H. Enslow, 155 E. 44th St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowldge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ——. (This information is required from daily publications only.)

EDWARD S. GILLETTE,
Business Manager.

Sworn to and subscribed before me this 30th day of September, 1938.

(Seal)

KITTIE C. WOULFE,
Notary Public.
(My commission expires Feb. 8, 1942.)

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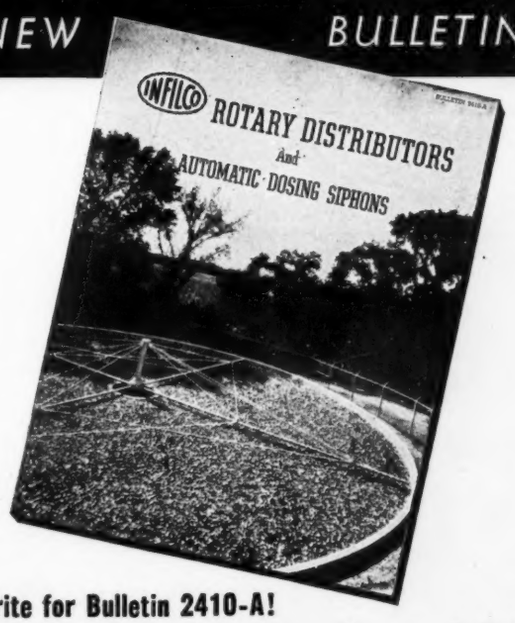

Write for Bulletin 2410-A!

Gives you important information on Infilco Rotary Distributors and Automatic Dosing Siphons. Points out their advantages. You need a copy of this bulletin for your files.

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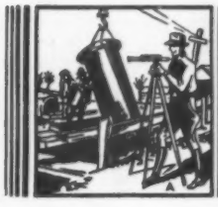

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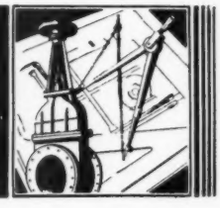

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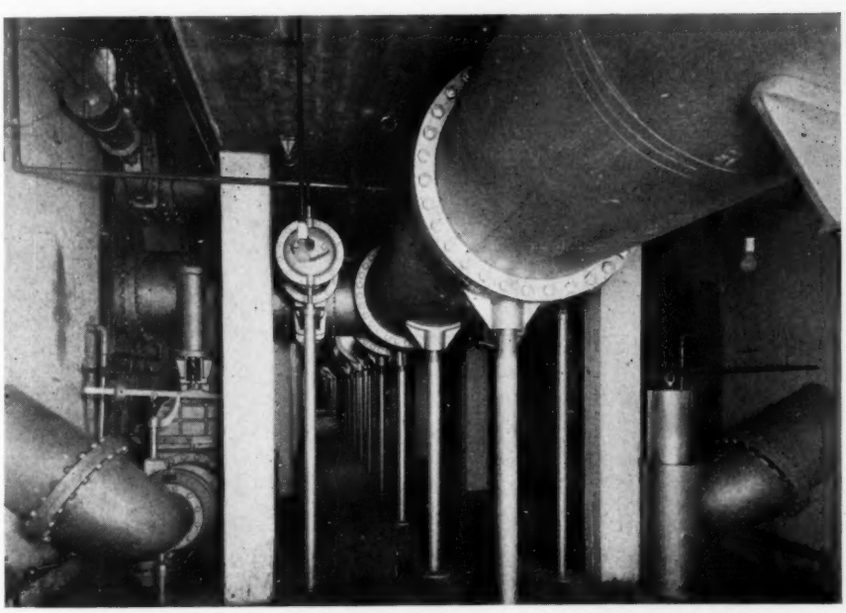

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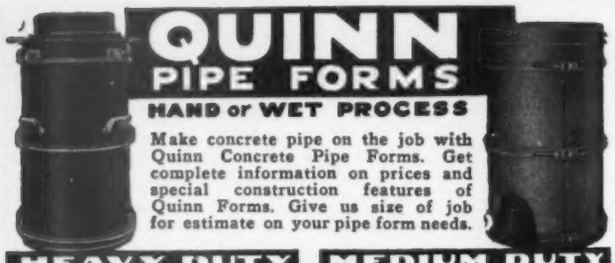

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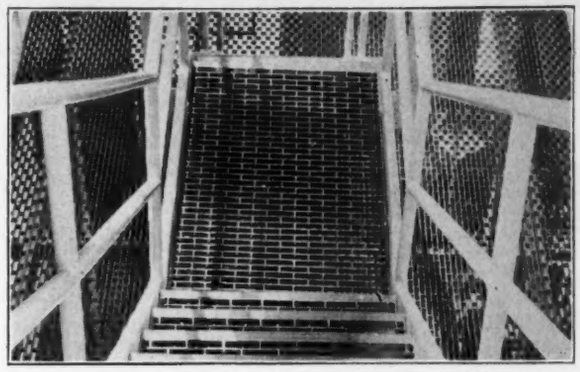

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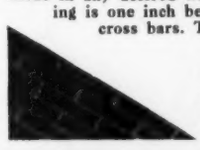

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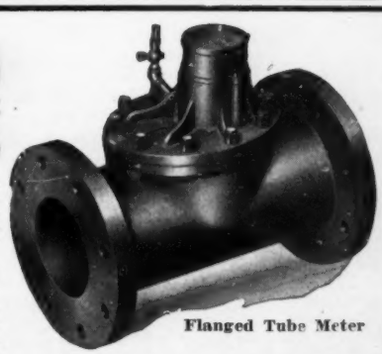

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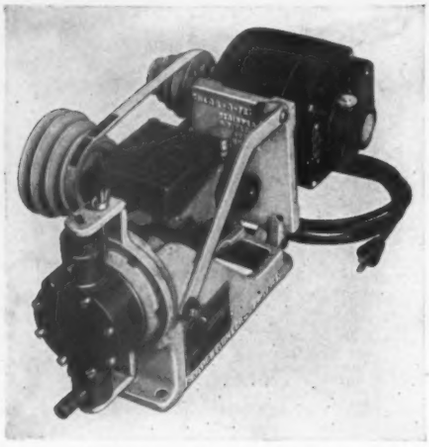

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Columbian Iron Works 1085
Corning Glass Works. —
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D

Darco Corp. 1014
Dorr Company, The Third Cover
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E

Eastern Gas & Fuel Asso. —
Edson Corporation, The 1084
Electro Bleaching Gas Co. —
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F

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G

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H

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*Hudson Coal Co. —
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I

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J

*Johns-Manville 1011-1019

K

Klemp Co., Wm. F. 1085
Knowles, Inc., Morris 1083
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L

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*Proportioneers, Inc. 1086

Q

Quinn Wire & Iron Works 1084

R

Reilly Tar & Chemical Corp. —
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Riddick, Thomas M. 1083
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S

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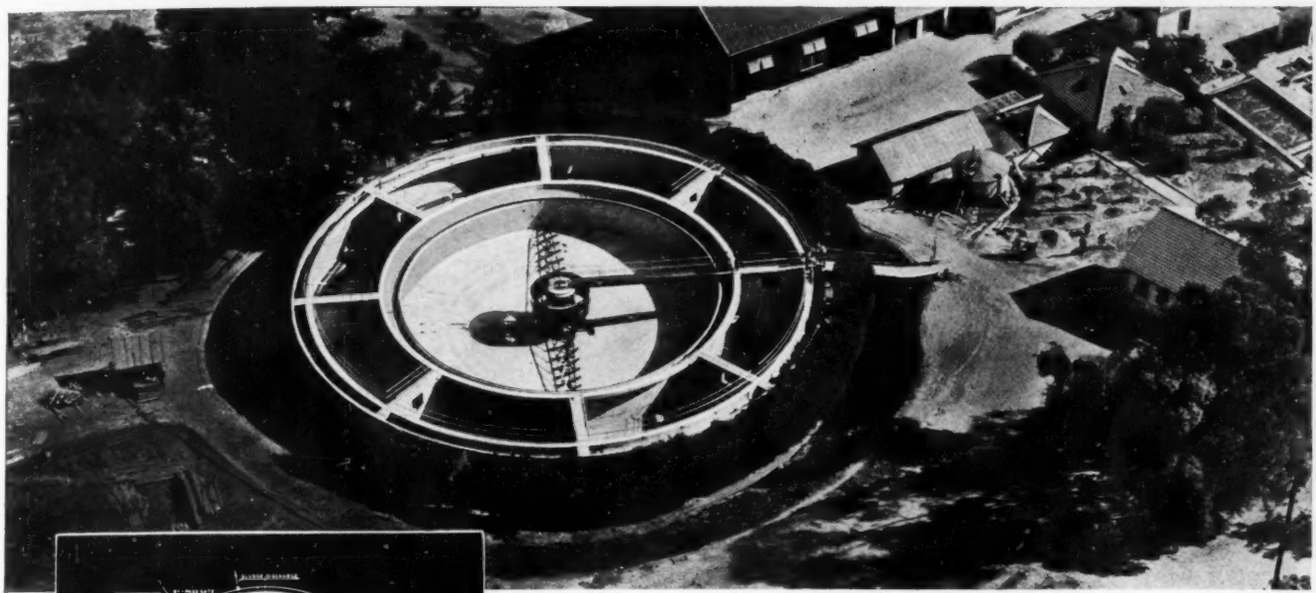

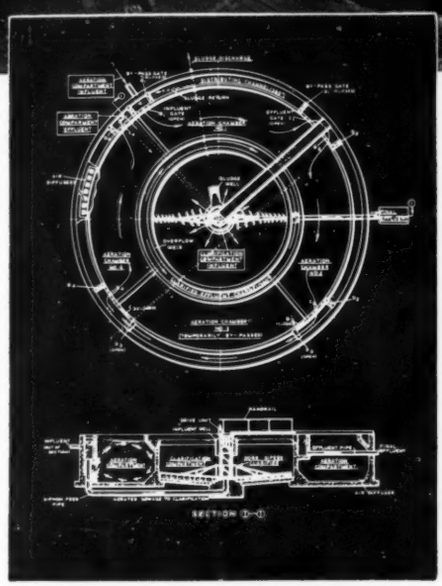

Currie Claraetor at Pasadena, Cal.
Consulting Engineer: Frank S. Currie, San Bernardino, Cal.

...with the Currie Claraetor

The Currie Claraetor provides Clarification and Aeration in a single tank. It brings the Activated Sludge Process within the range of small and moderate sized communities with populations ranging from 5000 to 15,000 and upwards.

Installed and operating costs are generally less than for multiple tank installations of the same capacity. Operating results are comparable with those at large plants employing separate tanks for clarification and aeration.

The Currie Claraetor tank is subdivided by a circular wall into two compartments. Aeration, either by diffused air, mechanical means or a combination of the two, takes place in the outer, annular compartment. Clarification with a Dorr Sifeed Clarifier takes place in the inner, circular one.

The Dorr Company has acquired exclusive American rights to the Currie Claraetor from the inventor, Frank S. Currie, consulting engineer of San Bernardino, Cal.

ADVANTAGES

Compactness: One tank does the work of two.

Low First Cost: Less than equivalent capacity in separate tanks.

High Efficiency: Comparable with large multiple tank installations.

Flexibility: Any one or all of aeration chambers may be removed from service without interrupting plant flow.

Write now for Leaflet 6581-C, describing the Currie Claraetor and containing operating data from four installations.

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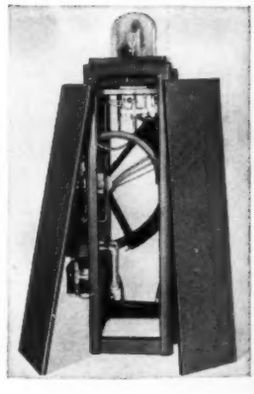
Write today for technical publications describing W&T Visible Vacuum Chlorinators, available in capacity and arrangement for any type or size of plant.



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